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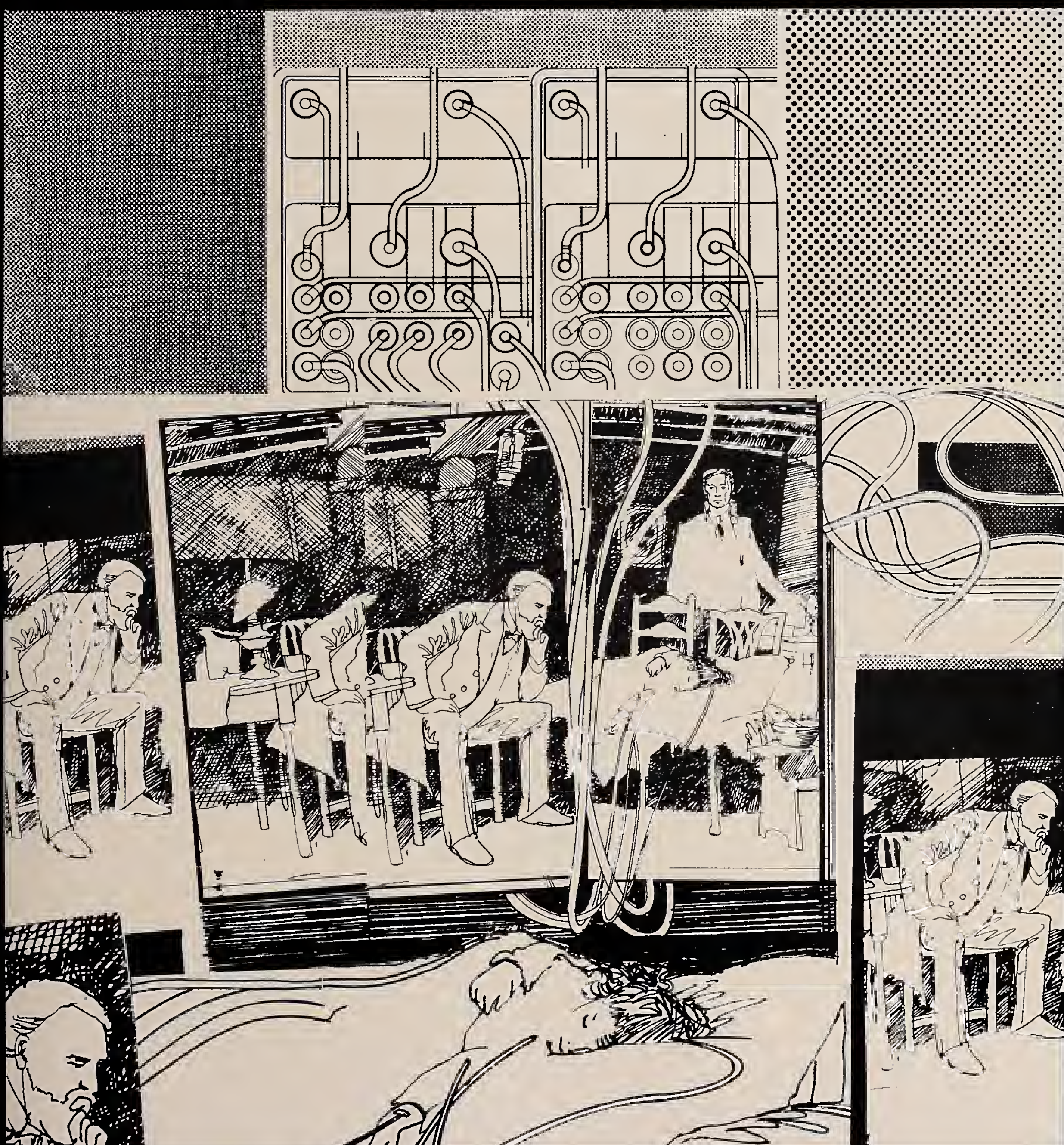
Harvard Medical Alumni Bulletin

September/October 1978



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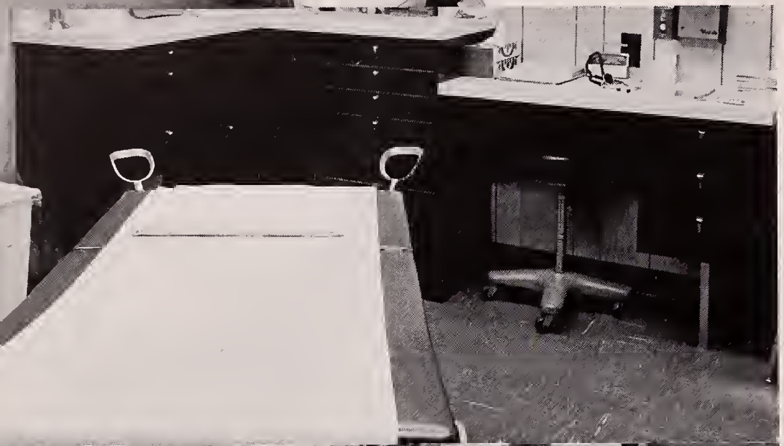

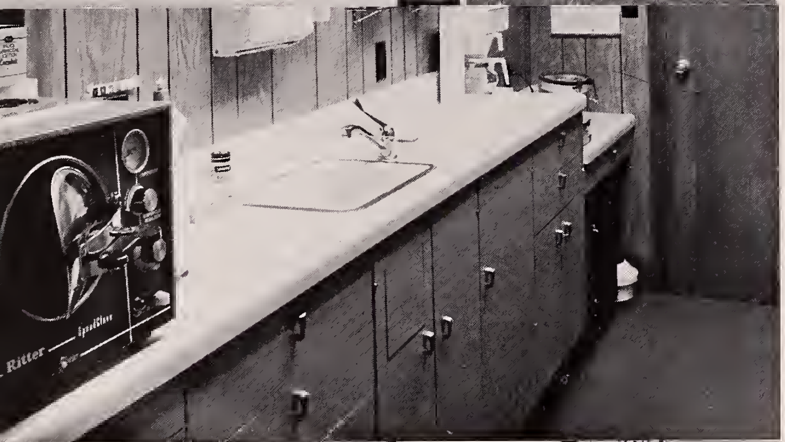

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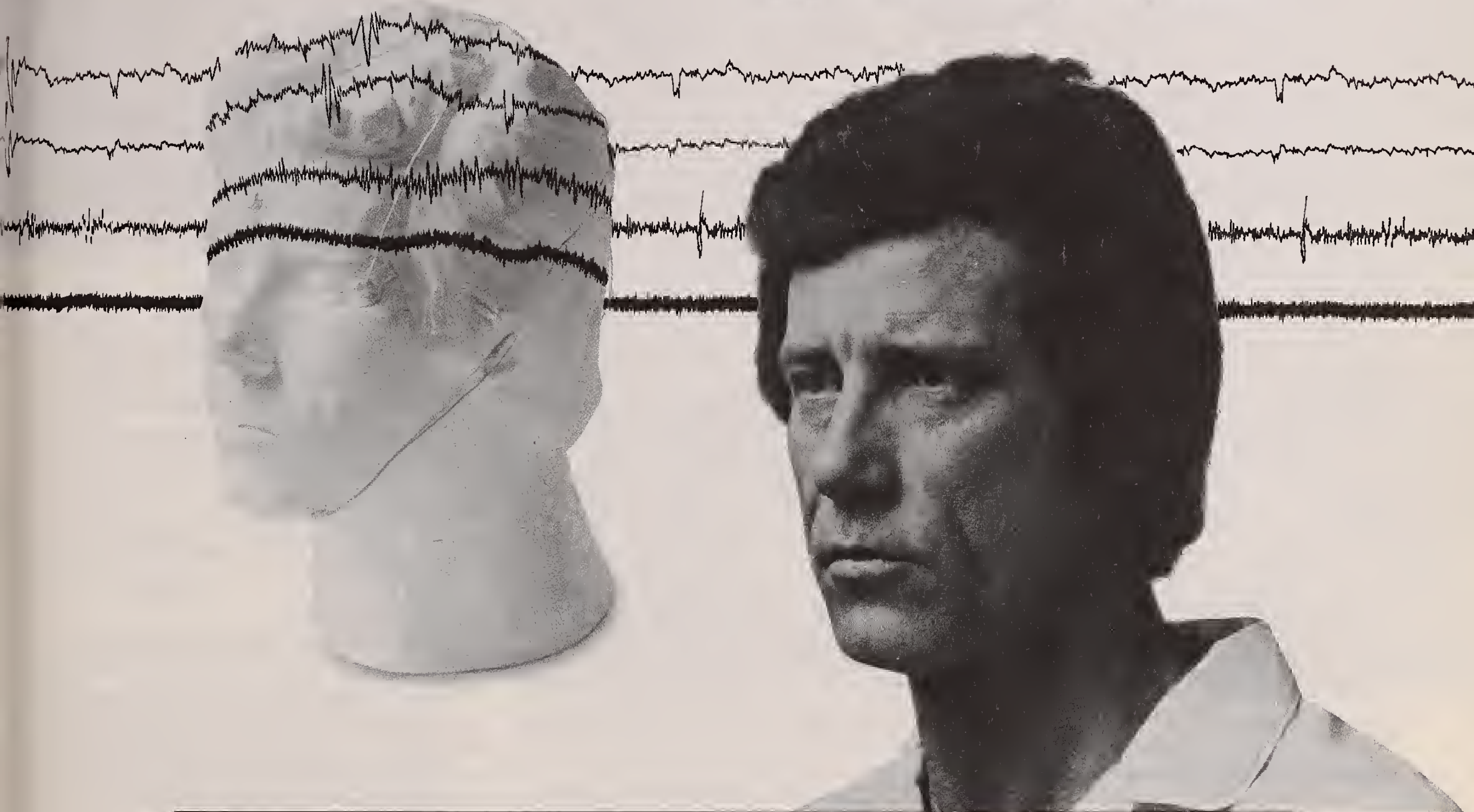
Cover: The resemblance of this drawing to the famous 1891 painting *The Doctor* by Sir Luke Fildes (featured on the cover of the July/August 1975 HMAB) is more than coincidental. In fact, Franz Ingelfinger '36 conceived the drawing for us in an article entitled, "Medicine: Meritorious or Meretricious" in the May 26, 1978 issue of *Science*. In sorting out the reasons why Americans are so critical of modern medicine, Dr. Ingelfinger imagines how *The Doctor* would be painted today, when technology has become a sine qua non of medical practice.

Credits: Cover, pp. 15, 24, 26, David Stokes; pp. 5, 6, 11, 12, Steve Gilbert; p. 9, Andrew Partos; p. 10, Don Basler; pp. 17-19, 33, 35, 37, Deborah Taylor; pp. 21, 23, Antonio Mendoza; pp. 27, 30 (top), H. William Taeusch, Jr.; p. 29 (top), The Bettman Archive; pp. 29 (bottom), 30 (bottom), Bradford F. Herzog; p. 31, Daniel Bernstein; p. 48, courtesy of Dr. Robert M. Donaldson, Jr.



Overview

Class of '82: "The best and the brightest"

Some nine months ago, while Boston was inundated with blizzard upon blizzard, a select group of men and women received harbingers of their futures — letters of acceptance from Harvard Medical School. On September 5, in the warmth of an early autumn day, these 165 individuals came together in Amphitheater C as the Class of 1982. In their first few hours as medical students, they received an official welcome from the administration. Dean Daniel C. Tosteson jumped ahead to the future and informed the students of the significance of their graduation date — it will mark the 200th anniversary of Harvard Medical School. "You will symbolize all students who have studied here over the years," said the Dean. "It is that living tradition that you join today." He then related his thoughts on a strategy for their medical education, attuning them to the lifelong task that they face of synthesizing enormous amounts of knowledge.

The alumni association was represented by director Perry J. Culver '41 who exclaimed, "You are the best and the brightest, and you will all be graduated from this school. It is more difficult to get out of Harvard Medical School without a degree than to get in." Dr. Culver expressed the interest of the alumni/ae in all areas of medical school life, and informed the audience that they automatically become members themselves after paying their first term bill.

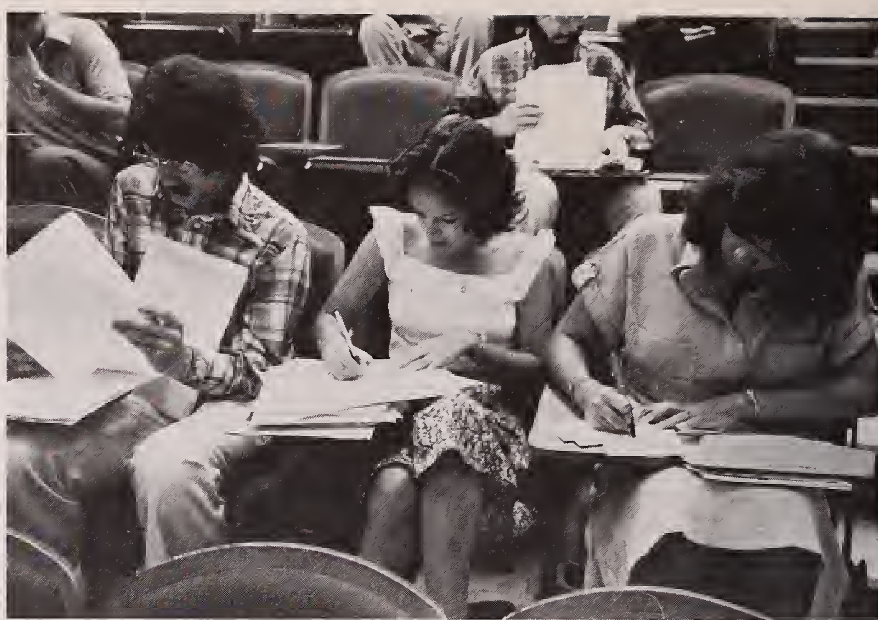
The orientation continued with Deans Daniel Federman and S. James Adelstein who spoke about their respective concerns. The welfare of medical students is one of Dr. Federman's principal responsibilities, and he reassured the new arrivals that "the size, depth, diversity, and versatility of our faculty can meet almost any need you have." Dr.

One of the many activities during orientation was a picnic on the Quadrangle, where — from the perspective of their third day at HMS — first year students had a chance to socialize with their second year confreres. Registrar Noreen Koller (below) had all the new arrivals under alphabetical control during registration.

Adelstein, whose job is to keep all academic programs on course, described the curriculum — the changes made over the past ten years, the choices offered, and the how-to of planning one's own program.

The role of the faculty advisors who serve as academic guideposts to small groups of students throughout their four years, was explained by Peter Reich '56, chairman of the board of advisors. Students plan their programs with the help and approval of these advisors. The matchmaking, however, is not done on the basis of the advisor's particular discipline.

Dr. Samuel Bojar, staff psychiatrist at the Medical Area Health Services, gently reminded the students not to ignore their own health in their pursuit of knowledge about disease. "Neither special immunities nor susceptibilities are conferred on you by entering the medical profession," he remarked.



After filling out forms and listening to words of welcome and instruction, the students' first day started to wind down with an al fresco reception given by the committee on admissions in the courtyard of the Seeley G. Mudd Building.

This class was the first to be chosen with Oglesby Paul '42 as director of admission, and the statistics that have been compiled point to a class selected for both its diversity and excellence. Of the newly matriculated students, 119 are men and 46 women, a change in the 1977 ratio of 111:54. The total applicant pool of 3,701 reflects a four per cent reduction over that of 1977 (nationally, a ten per cent reduction occurred). The proportion of male to female applications was 2,670 to 1,031, as compared to 2,766 to 1,095 in the previous year.

In the minority category, the numbers applying to the numbers registering were as follows: blacks, 239:18; Chicanos, 57:8; Puerto Ricans (mainland), 43:4 and one from the island; Native Americans, 9:1; Orientals, 229:9. According to Dr. Paul, the numbers of minority students in the class are essentially unchanged from 1977.

The statistics for alumni/ae and faculty offspring show six accepted out of thirty-four applicants from the first group and four out of eighteen from the latter. However, three of the four faculty children happen to have parents who are alumni of HMS as well. For both groups, there is a twenty-two per cent acceptance rate.

Harvard complied with the one year law requiring that medical schools increase their enrollment five percent by taking as transfers Americans studying abroad or graduates of two year American medical colleges, prior to October 1976 [see Jan./Feb. HMAB, p. 4]. As a result, nine of the ten transfer students into the second and third year classes were accepted under the provisions of this law. The fourth year class has two new students who already have earned their D.M.D. degrees at Harvard and will receive medical degrees as part of a five year oral surgery program sponsored by the School of Dental Medicine, the Medical School and the Massachusetts General Hospital.

As in previous years, the states with the largest number of first year students are New York with 43; California with 22; Massachusetts with 18; New Jersey with 17; Illinois with 11; Pennsylvania with 6; and Connecticut with 6. The greatest number of acceptances came from the following schools: Harvard/Radcliffe with 35; MIT with 17; Stanford with 8; Yale with 7; Princeton with 6; Brown with 5; and University of California, Berkeley with 5.

This year, Dr. Paul noted, 49 of those accepted withdrew prior to matriculation. "Some of these will be returning to us after completing fellowships abroad," he added, "and some went elsewhere because of finances. For the remainder there were varied personal reasons." For the 165 students who did accept, they are, in the words of Dean Tosteson, "beginning not a sprint, but a marathon."

Dean's appointees: a full house

As Daniel Tosteson's tenure as Dean of Harvard Medical School enters its second year, Building A is still humming with the vibrations of fresh possibilities and new people to make them real. This fall, the Dean's administrative team has been enhanced by the arrival of three new members, and two already familiar administrators have moved into larger areas of responsibility.

There seems to be a consensus at HMS that working in the student affairs office requires the patience, humanism, insight into human nature and counseling skills that are particularly cultivated

by a certain medical specialty. Taking over for Associate Dean of Student Affairs and fellow psychiatrist Alvin F. Poussaint is psychiatrist **Carola B. Eisenberg, M.D.,** newly named Dean of Student Affairs. "The Student Affairs Office is concerned with the student as a young adult still in the process of developing, not just as a working and thinking machine. These are the crucial years for the realization of individual potential. It's our job to see that the amount of stress — which can be enormous for a medical student — is kept within manageable limits."

She has been counseling and administering services for students just across the river for the past six years, as dean for student affairs at the Massachusetts Institute of Technology. Dr. Eisenberg first came to MIT in 1968 as a member of the psychiatric staff of the school's medical department, after having been an assistant professor of psychiatry and pediatrics at Johns Hopkins. Not an unfamiliar face to HMS students, she has been for the past decade a lecturer in psychiatry here, as well as a consultant in psychiatry at the Massachusetts General Hospital. She is also already involved with Harvard's affairs as a member of the visiting committee on the University Health Service.

The indefatigable **Eleanor Shore '55,** who for the past six years has been assistant to President Bok for health affairs, has been appointed to the new position of Associate Dean for Faculty Affairs. With some 3,000 people holding appointments within the faculty of medicine — nearly 1,000 of whom have faculty status — such a diverse group needs some looking after, and Dr. Shore will be involved in refining and developing new policies and procedures for faculty appointments and promotions. Because of "the magnitude of the problem of developing a responsive and effective organization," she will be helping to resolve problems in the internal governance of the faculty, especially as regards the activities of numerous standing committees. "The most valuable resources the medical school has are its faculty and students, and *time* is the faculty's most precious asset. My job is to maximize the return on faculty time spent on administrative and organizational matters."

In collaboration with S. James Adelstein '53, the Dean for Academic Programs, Dr. Shore will be working to implement those recommendations of the Liaison Committee on Medical Education (based on the recent Self-Study) that are pertinent to the faculty. Her old position? She will continue in it part time, with the emphasis switching from "everything" to interfaculty programs such as the HMS-MIT Division, the University Committee on Biological Sciences and the study of problems of premedical education. In addition, Dr. Shore will continue to see patients at the University Health Services, as she has since 1959.

Every year it becomes a little bit harder to imagine Harvard Medical School without **Henry Meadow.** A financial administrator here since 1950, he has worked closely with three successive deans, and has safely charted the school's fiscal course between the internal stresses of tremendous growth and the external strains of recession and inflation. Mr. Meadow has now changed his hat as Dean for Business and Finance for that of Dean for Planning and Special Projects for HMS, which will enable him to concentrate his energies on guiding the school in the new directions outlined by Dean Tosteson and by the Institutional Self-Study Committee.

Stepping into Henry Meadow's hard-to-fill shoes as Dean for Business and Finance is **Mitchell Adams,** an alumnus of the Harvard Business School, who merely walked down the street to his new quarters in Building A from his old office at the Beth Israel Hospital. Before coming to the BI as budget director in 1976, he had spent two years analyzing hospital facilities and their costs as a senior program analyst in the Certificate of Need Program of the Massachusetts Department of Public Health. Mr. Adams's earlier experience is in real estate development and investment management. He is also one of the founding trustees of Project Place, one of Boston's largest youth counseling and crisis intervention service organizations; a former member of the social services review committee of the United Way; and a former consultant to southern black colleges in securing federal financial aid for students.

One of HMS's needs most strongly emphasized both by Dean Tosteson and by the recent Institutional Self-Study report is for increasingly energetic fund-raising efforts in the years to come. Chosen to spearhead this initiative as the new Dean for Resources is **Alan C. Olsson,** former vice president for external affairs at Rensselaer Polytechnic Institute in Troy, New York. Mr. Olsson successfully secured both governmental and private philanthropy at Rensselaer for eleven years, serving as associate director of development and then as director of development before taking on his most recent post in 1971. Previously he had worked in the investment field as mortgage loan consultant, vice president, and finally president of the Krona Investment Company, Inc. of San Francisco.

Medical leaders film fest

Five men who have cast long shadows in the medical world are the subjects of this year's Leaders in American Medicine film series at the Countway Library: Varaztad H. Kazanjian '21, Hans Selye, M.D., William Dameshek '23, Charles H. Best, M.D., and Sigmund Freud, M.D.

Four of the five films are independent productions, on loan for the occasion. "Stress — the World of Hans Selye" was supplied by Informedia Productions, Ltd., of Vancouver; Dr. Dameshek was filmed in his clinic for "Auto Immune Disorders" by the Schering Corporation; the segment on Dr. Best was filmed in conjunction with the series Making Canadian Medical History, produced by the Hannah Institute in cooperation with instructional media services at the University of Toronto; "Sigmund Freud, his Family and Colleagues, 1928-1929" comes from the archives of the American Psychoanalytic Association.

Varaztad H. Kazanjian '21 (1879-1974), professor of plastic surgery, emeritus, HMS. October 11, 1978. *Discussants:* Bradford Cannon '33, clinical professor of surgery, emeritus, HMS; John M. Converse, M.D., Lawrence D. Bell Professor of Plastic Surgery, New York University School of Medicine and director, Institute of Reconstructive Plastic Surgery, NYU Medical Center; Walter C. Guralnick, D.M.D., professor of oral surgery at the Massachusetts General Hospital, Harvard School of Dental Medicine.

Hans Selye, M.D., Ph.D., D.Sc., professor of experimental medicine and surgery and director, Institute of Experimental Medicine and Surgery, University of Montreal. November 8, 1978. *Discussants:* Hans Selye, M.D.; George W. Thorn, M.D., Samuel A. Levine Professor of Medicine, Emeritus, and Hersey Professor of the Theory and Practice of Physic, Emeritus, HMS; Sanford I. Cohen, M.D., professor of psychiatry, Boston University School of Medicine.

William Dameshek '23 (1900-1969), professor of medicine, emeritus, Tufts University School of Medicine; professor of medicine, emeritus, Mt. Sinai School of Medicine. February 7, 1979. *Discussants:* William C. Moloney, M.D., professor of medicine at the Peter Bent Brigham Hospital, emeritus, HMS; Robert S. Schwartz, M.D., professor of medicine, Tufts University School of Medicine; Jane F. Desforges, M.D., professor of medicine, Tufts University School of Medicine.

Charles H. Best, M.D. (1899-1978), director emeritus, department of physiology, professor of physiology, emeritus, and director emeritus, Banting and Best Department of Medical Research, University of Toronto. March 7, 1979. *Discussants:* Alexander Marble '27, clinical professor of medicine, emeritus, HMS; George F. Cahill, Jr., M.D., professor of medicine, HMS, and director of research, Howard Hughes Medical Institute.

Sigmund Freud, M.D. (1856-1939), professor, University of Vienna. April 4, 1979. *Discussants:* Edward L. Bernays, L.H.D., LL.D., nephew of Sigmund Freud; Miles F. Shore, '54, Bullard Professor of Psychiatry at the Massachusetts Mental Health Center, HMS; John E. Mack '55, professor of psychiatry at the Cambridge Hospital, HMS.

This series is sponsored by a grant from the Josiah Macy, Jr., Foundation to the section on the history of medicine of the Boston University School of Medicine. Tufts, Boston University and Brown medical schools, the Benjamin Waterhouse Medical History Society, and the Boston Medical Library all share in the format of the series, with George E. Gifford, Jr., M.D., acting as the coordinator. Each program gets underway at 4 p.m. — a half hour for refreshments first.

Bulletin Board

Want to place an ad?

1) The *Alumni Bulletin* is published six times a year. The dates of publication and copy deadlines are: **Jan./Feb. — Jan. 1; Mar./Apr. — March 1; May/June — May 1; July/Aug. — July 1; Sept./Oct. — Sept. 1; Nov./Dec. — Nov. 1.** 2) Per word (single insertion) 10 word minimum, 50¢; Per word 2 times in one contract year, 45¢; Per word 6 times in one contract year, 40¢; 3) Payment for all insertions must be received with the copy. 4) Post Office box number counts as two words. Telephone numbers count as one word. No charge for Zip Code. We are unable to accept HMAB box numbers. 5) Send orders to: Harvard Medical Alumni Bulletin, 25 Shattuck St., Boston, MA 02115

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Marlow B. Harrison '36: Looking to the future, remembering the past

Almost everyone who entertains the idea of a medical education seeks outside financial support, and then once the M.D. is bagged, the student becomes an indebted doctor, often for a double-digit amount. It's a financial obligation to be rid of, nothing more. But when someone feels a moral debt for his education and pays it back with interest, he is no longer strictly balancing the cash flow.

It has been over forty years since Marlow B. Harrison '36, heard the words "Ezekiel Hersey Professor of the Theory and Practice of Physic" (attached to one Henry Christian), and thought what a wonderful title it was and how gratifying it would be if some day his parents' names could be similarily memorialized — to show his pride for what they had done for him.

Dr. Harrison, who transferred to HMS from Stanford in 1934, made internal medicine his career choice. His office practice in San Francisco gave him great satisfaction during the years 1945 to 1977, and before Stanford Medical School moved south to Palo Alto in 1959, Dr. Harrison was on its faculty as associate clinical professor of medicine. For the last eight years, he was also Western Area Medical Director for American Telephone and Telegraph Company Long Lines. In the past few months he has started on a new part time occupation — examining business executives and emphasizing health maintenance.

While Dr. Harrison has not been back recently to his alma mater, he has not forgotten those great teachers who did more than circle a path from laboratory to classroom. He remembers personalities who dominated the academic landscape. "I had magnificent teachers such as Chester Jones, Fuller Albright, James Means and Paul Dudley White. They imbued us students with great background and appreciation for taking care of the sick. Today, unfortunately, we are frequently seeing people doing clinical medicine who are running a mill. In my opinion, Harvard should turn out students who are interested in patients as total people, rather than in pursuing medicine mostly for its monetary rewards. To paraphrase Dr. M. S. M. Watts, the physician should take care as much as cure."

Dr. Harrison talks of an intangible debt to his parents who sent him to college at Stanford in 1929 — on the verge of the depression — and paid for his education in full. For an "ordinary middle class family" this was not easily done, and even though Dr. Harrison's father was a successful insurance broker in later years, he and his wife did not enjoy many niceties when they were first married. "My father was from rural Tennessee, and orphaned at the age of three. He was reared by an older sister who had a number of children of her own. He went to school in a one-room country schoolhouse until the fifth grade; then it was his turn to help out his large 'adopted' family by splitting rails, picking cotton and peanuts, and the like. My mother was able to finish only the first year of high school and obviously never realized her desire to become an architect. It makes you stop and think how much they did with what they had."

By carefully saving part of the family's modest income, his parents were ready, when the time came, to send their son to college. It was decided that Dr. Harrison, at the age of sixteen, should have his own checking account to learn something of money management, and he then was held accountable for all his college costs. Having always been grateful for what his parents did for him at much sacrifice to themselves, including providing his Harvard medical education, Dr. Harrison wondered "if it would ever be possible to show my appreciation."

Dr. Harrison: emphasis on the clinical

Through a deferred gift to Harvard that will eventually culminate in the Persis, Cyrus, and Marlow B. Harrison Professorship in Clinical Medicine, he has made a redoubtable showing of his appreciation. His initial gift of one hundred thousand dollars will be augmented by testamentary accounts plus other assets that will be capitalized until the requisite amount to endow fully the named professorship is attained. "Not in any sense of the word a millionaire," Dr. Harrison put to good use his father's admonition that "a man who makes ten dollars a month and saves fifty cents is better off than the man who makes a hundred dollars and saves nothing." Because of his ties to and respect for clinical medicine, Dr. Harrison has stipulated that his named professorship be occupied by a teacher of clinical medicine. "I would hope that my contribution will assist Harvard in producing expert clinicians with the idea instilled in them that the care of patients on a person-to-person relationship is still the best medicine."

Recommended reading: Mark D. Altschule '32, Mrs. Judith Miller, and Richard Wolfe celebrated the publication of *Poems: Partly Medical*.

Poems: Partly Medical

A recent celebration of the poetic expression of the late Benjamin F. Miller '33 prompted the comment from Mark D. Altschule '32 that his Medical School roommate had successfully crossed the boundary between medicine and literature — he was as totally absorbed and proficient in medicine as in poetry. The celebration was for the publication of *Poems: Partly Medical,* which constitutes the first collection of poems by a physician in the archives of the Boston Medical Library.

Dr. Altschule, who wrote the introduction, spoke at a gathering of Dr. Miller's colleagues, friends, and family. "We regard this book as indicative of at least part of what medicine represents." Unlike many physicians who write poetry to escape the tragedy of illness, Dr. Miller fluently combined the insight of the physician to "sufferings in the sickroom," as he himself noted, and the visual sense of the poet that "spark[s] a strong emotion," whether lamenting the murderous path of the Holocaust or describing the tender relations between men and women.

In choosing from Dr. Miller's work, all of which he wrote during the last eight years of his life, Dr. Altschule and Richard Wolfe, librarian of the Rare Book Room, were guided by poet David McCord in selecting poems with intrinsic technical value. Mr. McCord remarked that Dr. Miller was "an extraordinarily good writer . . . when some of us [poets] are recognized, it is well-deserved."

Dr. Miller is probably better known to his medical peers as author of *The Complete Medical Guide,* which is now in its fourth revision. He was also recognized for his pioneering work in kidney transplantation and for important research on atherosclerosis.

Poems: Partly Medical is available as a limited edition from the Rare Book Room of the Countway Library of Medicine at 10 Shattuck Street, Boston, Massachusetts 02115 for $9.95.

Class of 1982

Abraham, Susan G.
Mamaroneck, N.Y. (Barnard)

Arbabi, Linda M.
Bethesda, Md. (Univ. of Maryland)

Barnett, Patrick A.
Philomath, Ore. (Univ. of Oregon)

Becker, Carolyn
Cincinnati, Ohio (Univ. of Pennsylvania)

Beckman, Robert A.
Oreland, Pa. (Harvard)

Bedinghaus, Joan M.
Somerville, Mass. (Univ. of Massachusetts, Boston)

Bigham, Harry
Lancaster, Pa. (SUNY at Binghamton)

Birnhaum, Paul S.
Jackson Heights, N.Y. (SUNY at Albany)

Blades, Edmond
Melrose, Mass. (Harvard)

Brandt, James
Monterey, Quebec (Yale)

Brinberg, Don E.
Yonkers, N.Y. (Johns Hopkins)

Bromberg, Jonathan S.
Cincinnati, Ohio (Harvard)

Bubernak, Linda A.
Triangle, Va. (Univ. of Virginia)

Caligor, Eve
New York, N.Y. (Harvard)

Carter, Robert
Richmond, Va. (Williams)

Cibas, Edmund
Milton, Mass. (Harvard)

Clark, Ellis R.
Enon Valley, Pa. (Pennsylvania State)

Cook, Charles E.*
Belmont, Mass. (Case Western Reserve)

Crombie, Booker T.
Newark, N.J. (Rutgers)

Culig, Michael H.
McKeesport, Pa. (Harvard)

Curet, Myriam
Verona, Wisc. (Bryn Mawr)

de Bara, Roberto
New Rochelle, N.Y. (Harvard)

DeLaney, Thomas
Convent Station, N.J. (Harvard)

Deutsch, Ezra
Englewood, N.J. (Yale)

DiBattiste, Peter M.
Philadelphia, Pa. (LaSalle)

Diller, Emmeline
Forest Hills, N.Y. (Radcliffe)

Dobbs, Paula C.
St. Louis, Mo. (Radcliffe)

Doherty, Neil E.
Philadelphia, Pa. (Univ. of Pennsylvania)

Dryer, Evan*
Scarsdale, N.Y. (Columbia)

Dubin, Jonathan
Brooklyn, N.Y. (Columbia)

Dushane, Theodore E.*
Santa Monica, Cal. (Yale)

Eigner, John B.
Lynn, Mass. (UC-Berkeley)

Ezell, Jerome C.
Harvey, La. (Xavier Univ.)

Flamburis, Diane M.
West Roxbury, Mass. (Yale)

Frosch, Matthew P.*
New York, N.Y. (Amherst)

Fung, Kaihi F.*
Hong Kong (UCLA)

Gemlo, Brett
Prior Lake, Minn. (Macalester)

Gibbons, Gary H.
Philadelphia, Pa. (Princeton)

Gilbert, Thomas J., Jr.
Elkron City, Ky. (MIT)

Glafkides, Michael G.
Hillsborough, Cal. (Stanford)

Goffney, Willie H.
Houston, Texas (Harvard)

Goldman, David W.
Buffalo, N.Y. (Univ. of Rochester)

Goldstein, Steven A.
New York, N.Y. (Brandeis)

Gonzalez, Ramon G.
Santa Cruz, Cal. (Univ. of Arizona)

Greco, Barbara A.
New Haven, Conn. (Yale)

Griem, Katherine L.
Portage, Ind. (Bowdoin)

Guerina, Nicholas G.
Marlton, N.J. (Pennsylvania State)

Gutierrez, Mary M.
McAllen, Texas (Rice)

Hahn, Jin Sang*
Bellevue, Wash. (Harvard)

Halaas, Gwen W.
Moorhead, Minn. (Concordia College)

Hartness, Charles C., 3d
Lafayette, Ga. (Univ. of Georgia)

Heller, Vicki
Detroit, Mich. (Univ. of Michigan)

Hendrix, Tina
Jamaica, N.Y. (Long Island Univ.)

Holmes, Laura E.
Somerville, Mass. (Harvard)

Huang, Paul L.*
New York, N.Y. (Columbia)

Hummel, Paul S.
Champaign, Ill. (Univ. of Illinois)

Husson, Robert N.
Fayettesville, N.Y. (Yale)

Ingenito, Edward P.*
Essex Fells, N.J. (MIT)

Inokuchi, Sharon
Pacific Grove, Cal. (UC-Berkeley)

Jasmine, Mark S.
Upper Saddle River, N.J. (Duke)

Jayes, Robert
Exton, Pa. (Univ. of Delaware)

Kaiser, Timothy
Bartlesville, Okla. (Univ. of Oklahoma)

Kamerer, Donald B.
Pittsburgh, Pa. (Yale)

Kamitsuka, Paul F.
New York, N.Y. (Earlham College)

Karfunkel, Perry R.
Amherst, Mass. (Queens College)

Khosla, Sundeep*
Cambridge, Mass. (Harvard)

Kirton, Orlando
New York, N.Y. (Brown)

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East Norwalk, Conn. (Brandeis)

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San Diego, Cal. (UC-San Diego)

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Norwalk, Cal. (UC-Irvine)

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New York, N.Y. (Princeton)

Lerner, Thomas H.
Chestnut Hill, Mass. (Princeton)

Levine, Benjamin
Elmont, N.Y. (Brown)

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London, Stephanie J.
Forest Hills, N.Y. (Radcliffe)

Mann, David A.
Springfield, Va. (Johns Hopkins)

Mark, David H.
Hayward, Cal. (Stanford)

Martin, John J., Jr.
Williamstown, Mass. (Williams)

Massaquoi, Steven G.*
Chicago, Ill. (Harvard)

Maynard, Edward C.
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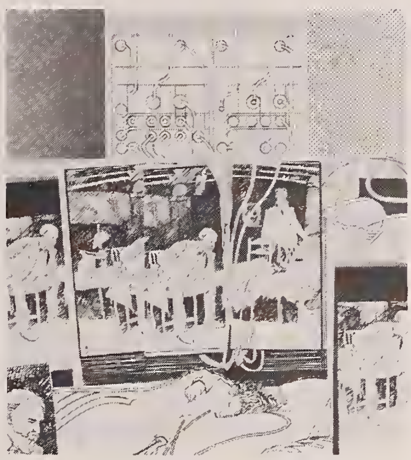
MANAGING OUR MACHINES



Those who are learning and practicing medicine cannot escape from the issues raised by modern technology. The machine has entered the medical school, hospital, and private office, exerting its influence on how we think, how we act, what we build, and what we pay for. This issue of the *Alumni Bulletin* is focused on aspects of technology that pose educational challenges for medical students and their instructors, and that create dilemmas for practitioners in the treatment of illness.

Technology has entered the educational process and is relied upon more and more in the fact-finding needed by physicians. My essay, "The medical student and the machine" describes the use of modern diagnostic devices, to demonstrate the need for comprehensive study of technology in the training of physicians.

In "Are computers and physicians compatible?" Octo Barnett, Howard Bleich, and Warner Slack discuss the evolving status of the computer in medical practice. They touch on technical, conceptual, and psychological difficulties of introducing the computer to doctors and patients, and speculate about future prospects. Managing editor Deborah Miller talked with the authors and provides a glimpse of some of the work-in-progress within the Harvard community.

Before technology can be applied to help solve medical problems, physicians will have to know the effects of different treatments. Ernest Cravalho delves into the questions that will have to be asked of new technology in "Choosing our means."

When machines work "miracles," they can also create problems whose solution may lie outside the usual realm of medicine. The collaboration by H. William Taeusch and Mary Ellen Avery, "Neonatal intensive care: incomplete solutions," centers on the crucial choices that therapeutic machines force pediatricians to make in the process of caring for severly ill infants. These choices hinge on ethics, clinical judgment, resource planning, and the unique and difficult place of the physician as decision-maker. "Being honest when technology fails" by Ned H. Cassem is a moving account of the role of the critical care committee of the Massachusetts General Hospital in assisting health personnel and patients to wisely use life-sustaining therapeutic devices. Both articles indirectly speak to the need of medical education to comprehensively study the consequences of therapeutic technology as well as the uses of diagnostic technology.

Our encounters with modern technology require a broad understanding of its limits and potentials. I join with the editorial board of the *Alumni Bulletin,* which participated in formulating the content of this issue, in hoping the viewpoints will help the reader co-exist with machines, as neither a detractor nor a worshipper.

Stanley Joel Reiser
Guest Editor

The medical student and the machine

by Stanley Joel Reiser

Modern medical students are immersed in a sea of technology. A large part of their education is passed in mastering its use, interpreting its findings. Like the hospital or the research laboratory, technology is commonplace in the medical landscape, part of the familiar scene, everywhere. Perhaps this is one reason why its general influence on practice is not considered explicitly and formally. Along with other pervasive parts of the medical environment, technology is learned about by being lived with, encountered in piecemeal fashion: a clerkship in radiology here, a rotation in ophthalmology there, now a patient needing lumbar puncture, later one requiring traction. If mastery occurs it is judged, essentially, by technical criteria, not by the student's understanding of the purposes or ends of technological usage, or its interpersonal effects.

In discussing the sort of issues that might be included in a broad pedagogical examination of technology, a distinction should be made between the technology of diagnosis and the technology of therapy. Each has somewhat different ends, each has been influenced by different historical events. This essay deals only with diagnosis.

Stanley Joel Reiser, M.D., guest editor of this issue, is an assistant professor and director of the program in the history of medicine, and author of Medicine and the Reign of Technology. *(Cambridge University Press, 1978).*

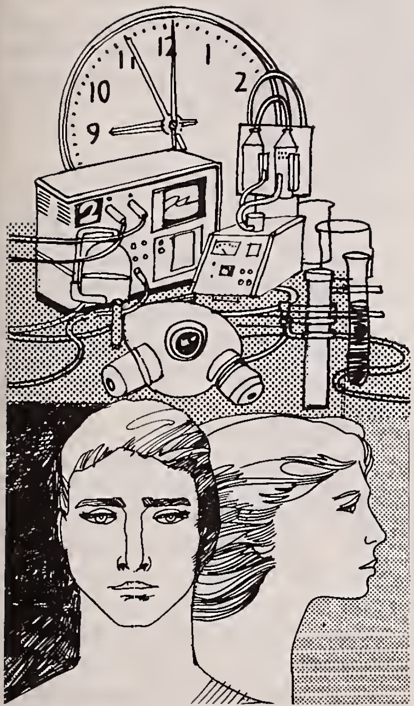
A central problem that bears on the process of learning about a patient's illness involves the choice of means. The current ethos in medicine directs the physician's diagnostic attention towards the application of technology, and away from evaluations based on making immediate sensory judgments, or inquiries into the patient's ideas about the illness.[1] This behavior is predicated on a number of assumptions that originate in the education process. One involves accuracy of means. It is widely believed that technological findings provide the most accurate answers to the problems of illness — objective answers more reliable than direct human judgments. Sometimes they do. But not always.

Often overlooked, one of the most important issues in medical education is observer variation and error. Studies done in this century — and even earlier — have found that almost every basic technique of diagnosis used is prone to significant degrees of error (generally between ten to twenty-five per cent) of two essential kinds. In one, observers evaluating a given piece of evidence — an auscultatory sound, an X-ray, an electrocardiogram — differ with each other in their interpretation of normality or abnormality. In another, the observer disagrees with him or herself about the meaning of the evidence, when viewing it at different times. Historically, from the standpoint of drawing attention to this problem, perhaps the most significant study of observer variance was made in the 1940s — and made without this objective being the initial intention of the investigators.

A group of three chest specialists and two radiologists collaborated to evaluate the effectiveness of the different sizes of X-ray films which had been used by military authorities in mass medical examinations of recruits and soliders. In the process of making these comparisons they discovered, to their surprise, that they disagreed with each other in their interpretations of pathology in about one third of the films reviewed, and with themselves when reexamining the films, about a fifth of the time. Human factors influencing perception and judgment, as opposed to technical ones, were found to be the most important causes. The differences occurred even though the group beforehand had specified the nomenclature they would use in describing lesions, and had developed a code for classifying the film into categories.[2] Astonished radiologists who reviewed these results and conducted separate trials of their own, confirmed the validity of the findings.

Similar variation in diagnostic results have been reported for laboratory tests. For example, since 1963 officials of the New Jersey Department of Health have sent test specimens to laboratories in the state to monitor their efficiency. Testifying before Congress in 1975, the state's assistant health commissioner reported: "Analysis of these unknowns

"Not only are students often inadequately trained in obtaining firsthand evidence, but they believe it inferior to data generated by technology."



by participating laboratories is often handled with particular care, since the laboratory is aware that it is being tested. This activity, therefore, provides a measure of capacity to perform rather than an accurate reflection of day-to-day performance. Moreover, the limits of error considered as acceptable in this activity have been quite generous."[3] However the results of 35,000 chemical analyses conducted over a decade by 225 laboratories showed that only twenty reported acceptable results more than 90% of the time. Half obtained satisfactory results less than 75% of the time, and nine laboratories less than 50% of the time. In some instances the results were far beyond the cut off point. For example, from a total of 1,573 uric acid determinations, 8% were in error by 20-30%, 4% by 30-40%, and 1% were off by more than 50%. New techniques of automated laboratory analysis promise to lower such variation, but not eliminate it. They too are vulnerable to human and technical error.

Studies of this kind can be cited for most other essential diagnostic techniques — history-taking, auscultation, microscopy and the like.[5] They show that every procedure we use in diagnosis is fallible and often, to more or less the same degree. Thus the laboratory test may not, in any given instance, be more accurate than the sign detected on physical examination or the statement elicited from the patient during history-taking.

Such consistent outcomes demonstrate that medical students must learn to recognize and understand their own margins of variation and error in the diagnostic techniques they personally perform, as well as in the procedures they commonly order. Implicit, too, is a need to examine how we teach students to diagnose illness.

There has been a decline noted during the twentieth century in the attention of medical educators to developing the future doctor's own personal powers of diagnosis — the ability to observe and question. The diminishing attention paid to physical examination has been commented on by skilled modern clinicians. For example, wrote George Engel in 1976: "With a few notable exceptions, relatively little time is devoted in the average undergraduate curriculum to supervised instruction in interviewing and physical examination. For the most part, the instructional staff is junior and inexperienced, the task sometimes being delegated to house officers or even to senior medical students. Often students are merely asked to report on their findings; they are not observed during the actual procedures. And only rarely is further attention given to checking clinical skills beyond the prescribed exercises in the first or second year. Evidently it is not deemed necessary to assay students' clinical performance once they have entered the clinical years."[6]

The teaching of patient interviewing, as Engel notes, suffers the same benign neglect. We are several generations removed from the pioneering work of Sigmund Freud and his followers, and their demonstration of the significance of the patient's beliefs and experience in understanding and treating illness. Yet the clinical interview is learned about principally through the personal experiences and random circumstances that are a part of hospital life. Relatively few medical students are exposed to a methodical exploration of how the patient's sensations and thoughts can be effectively elicited, interpreted, and integrated as key data in diagnosis. This continues despite the important aid given to these pedagogic efforts by videotape equipment, now capable of accurately, inexpensively, and unobtrusively capturing verbal and visual aspects of doctor-patient encounters. There has also been insufficient research into the meaning of the various sensations experienced by patients, data which would enhance the findings of the interview.

Not surprisingly then, students are insecure when depending on evidence directly revealed to their senses by physical examination, or disclosed by the patient. Not only are students often inadequately trained in obtaining firsthand evidence, but they believe it inferior to data generated by technology. A resident, who once took charge of the practices of several vacationing doctors found: "Of the patients I saw, I could seldom pick out a disease which I could recognize; for the most part, I found that patients came in complaining of a multitude of symptoms that did not fit any of the disease pictures I had seen or read about in textbooks. Often, there was not even a physical

sign to point the way to a physical diagnosis. I welcomed the day when I could take up my next resident appointment back in the sheltered atmosphere of the hospital. The pathology laboratory and X-ray department would exclude 'organic disease,' my chiefs could confirm there was 'no abnormality detected,' and the patients could be sent back to their own doctors."[7]

Insecurity of this type represents one cause for the failure of our educational system to encourage physicians to practice in rural areas or urban ghettos. The modern hospital, with its machines and its host of readily available specialists, has an irresistible pull on the practitioner. The need for more independence of judgment, for more reliance on diagnostic evaluations not mediated through technologic devices or consultants, places the student schooled to be dependent on them at a decided disadvantage when practicing in areas lacking such resources. To stimulate a more even distribution of physicians in our country, an emphasis in medical education on the skills and confidence to make independent clinical judgments is essential. We must develop in students the capacity to make a *balanced use* of the available techniques of diagnosis, and prevent the growth of an excessive reliance on any one mode.

How far a physician should go in seeking to diagnose a problem or to uncover hidden disease is one of the most fundamental yet perplexing issues of clinical practice. A noted American physician, David Barr, suggested that "discriminating selection of measures may be more important than unreflective completeness."[8] Dr. David Rogers observed in his 1975 presidential address to the American College of Physicians: "Today too many patients hospitalized in our teaching centers undergo workups that seem directed to all of the diagnostic possibilities that have been suggested by an array of skilled subspecialists, rather than a considered and sharply restrained series of studies directed toward the most likely or the most treatable one. In an effort to be 'thorough,' we seem to substitute a grueling, somewhat mindless workup for one that is discriminating. I think we have pursued the technologic imperative to do all that we are trained to do too far . . . This is not an exhortation to return to the 'the good old days,' or the abandonment of the laboratory, or less intensity in our scientific consideration of the human problems presented to us. It is rather a plea for more restraint coupled with more discrimination in the use of the powerful tools we now have at our command."[9]

There are many dilemmas connected with diagnostic inquiry. A moral one: the physician should do everything to prevent an illness from going undetected, meanwhile abiding by the ancient dictum of Hippocrates, "not to harm." A clinical one: determining in the first meeting with a patient which of all the evidence that can be gathered, should be. An economic one: how much of the patient's income should be expended for diagnostic testing, or how extenisvely should insurance plans be exploited? A legal one: how far should the physician go to prevent real, or feared, threats of suit for failure to use available procedures of diagnosis?

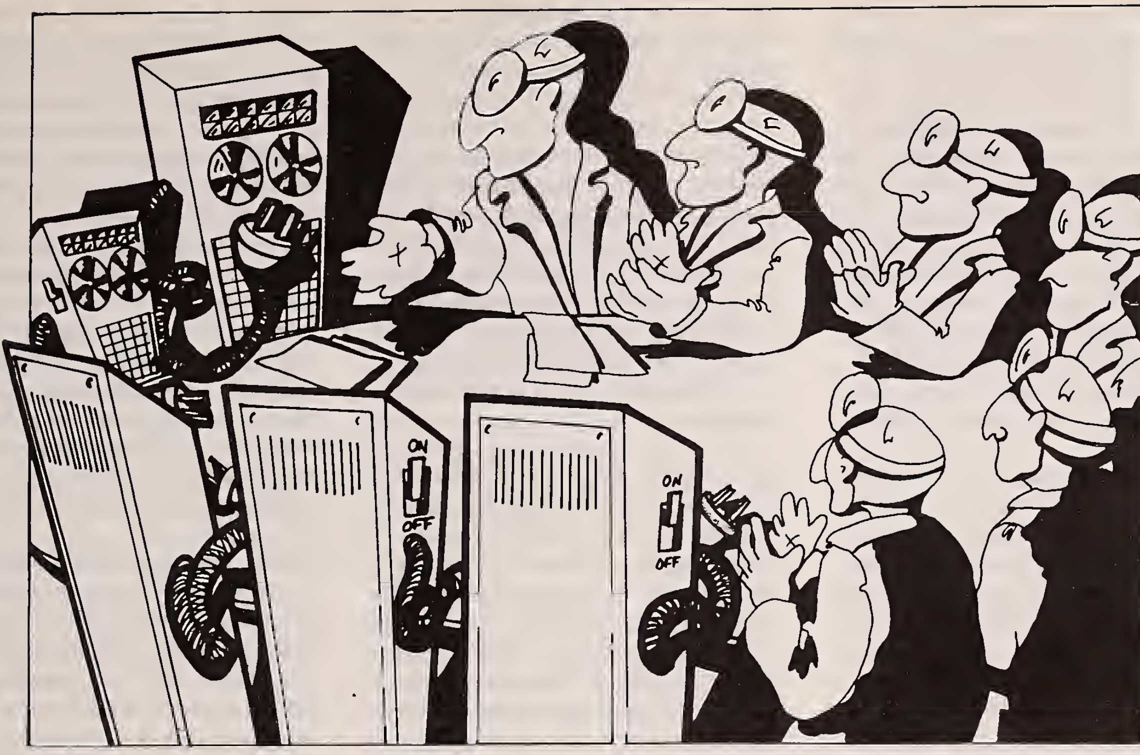
These concerns are, once again, too important to be left to the variable experiences of clinical clerkships. Although these questions recur in the care of patient after patient, formal rather than merely empirical treatment of the subject is needed. Indeed, lack of orderly and comprehensive instruction about a related aspect of medical care — the application and cost of laboratory procedures — has been singled out by physicians and legislators as a significant cause of excessive laboratory use.[10]

Finally, there is much to be gained in exploring with medical students the attitudinal and relational issues that selection of diagnostic techniques raise. A given technique does more than produce a fact. It represents a unique way of looking at diseases and patients. It becomes a screen interposed between a doctor and patient — admitting some facts and aspects of illness, blocking others. It thus affects the clinical relationship that will develop between them. Diagnostic techniques influence the physician's ability as a decision maker. Indeed, the self-image of doctors as healers is centrally shaped by the methods of evaluation they depend on. And the particular techniques used by a given generation of doctors are influential in determining the way in which medical services are ultimately organized.

Technology, through its influence on how we think and act, has become profoundly significant in medicine. Can we neglect any longer its systematic study in medical school?

References

1. The historical development of this process is examined in Stanley Joel Reiser, *Medicine and the Reign of Technology* (New York: Cambridge University Press, 1978).
2. Carl C. Birkelo, et al, "Tuberculosis Case Finding: A Comparison of the Effectiveness of Various Roentgenographic and Photofluorographic Methods," *JAMA,* vol. 133 (1947), pp. 359-66.
3. Dr. Martin Goldfield, U.S. Congress, Senate, Subcommittee on Health of the Committee on Labor and Public Welfare, *Clinical Laboratory Improvement Act of 1975* on S. 1737, 94th Cong., 1st Sess., 8 and 9 September 1975, p. 184.
4. Ibid.
5. See for example, Lorrin M. Koran, "The Reliability of Clinical Methods, Data and Judgments," *New Engl. J. Med.,* vol. 293 (1975), pp. 642-6, 695-701.
6. George L. Engel, "Are Medical Schools Neglecting Clinical Skills?" *JAMA,* vol. 236 (1976), p. 861.
7. Desmond O'Neill, ed. *Modern Trends in Psychosomatic Medicine* (London: Butterworth, 1955), p. 3.
8. David P. Barr, "Hazards of Modern Diagnosis and Therapy — The Price We Pay," *JAMA,* vol. 159 (1955), p. 1456.
9. David E. Rogers, "On Technologic Restraint," *Arch. Intern. Med., vol. 135 (1975), p. 1394.*
10. See for example, Patrick C. J. Ward, et al, "Systematic Instruction in Interpretive Aspects of Laboratory Medicine," *J. Med. Educ.,* vol. 51 (1976), pp. 648-9.



Are computers and physicians compatible?

by Octo G. Barnett, Howard L. Bleich and Warner V. Slack

Health care delivery and medical education are inherently information-processing activities, and their effectiveness depends on the communication, storage, and retrieval of information.

Most information used in patient care is handwritten, often hard to read, transcribed from sheets of paper of all sizes and descriptions, and hand-carried to different areas of the hospital. Information needed immediately is usually conveyed by telephone and often verbally transmitted among several individuals. Not surprisingly, the accuracy and completeness of the data are sometimes compromised. The medical record is a hodgepodge of information — a randomly organized, hieroglyphic scrapbook of physicians' notes, nurses' observations, test results, records of drug administration and therapeutic procedures, and a variety of miscellaneous clinical tidbits.

Medical information processing has become critically important because of changes in the methods of practice over the past four decades. There has been an enormous expansion of knowledge about disease etiology and manifestation, and a vast increase in the number and complexity of drugs and procedures in the therapeutic armamentarium. Since laboratory testing is now routinely used to quantitate the physiological and biochemical abnormalities, hours of clerical labor are required to transmit the results from laboratory to care units, to record the data in the medical record, and to bill the patient.

The longer life expectancies of the population have been associated with a concomitant rise in the incidence of chronic disease. As a result, the nature of medical practice has changed to give a greater emphasis to continuity of care. Specialization has created a myriad of health workers — primary care physicians, house staff, specialists, radiologists, nurses, social workers, nutritionists, respiratory therapists and the like — all of whom must collaborate in patient care. In these circumstances, the medical record has assumed a critical role as the primary means of communication among the members of the health care team.

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The shortcomings of the record are becoming ever more apparent. The cost of personnel to collate medical data is rapidly escalating. Physicians are repeatedly frustrated by the difficulty of locating specific items in a patient's record or of finding the record itself. Clinical investigations that demand collection of significant amounts of data are so time-consuming that they are often prohibitively expensive. National planning for medical care delivery is difficult because of the problems of learning who is getting what type of care, for what reason, and with what outcome.

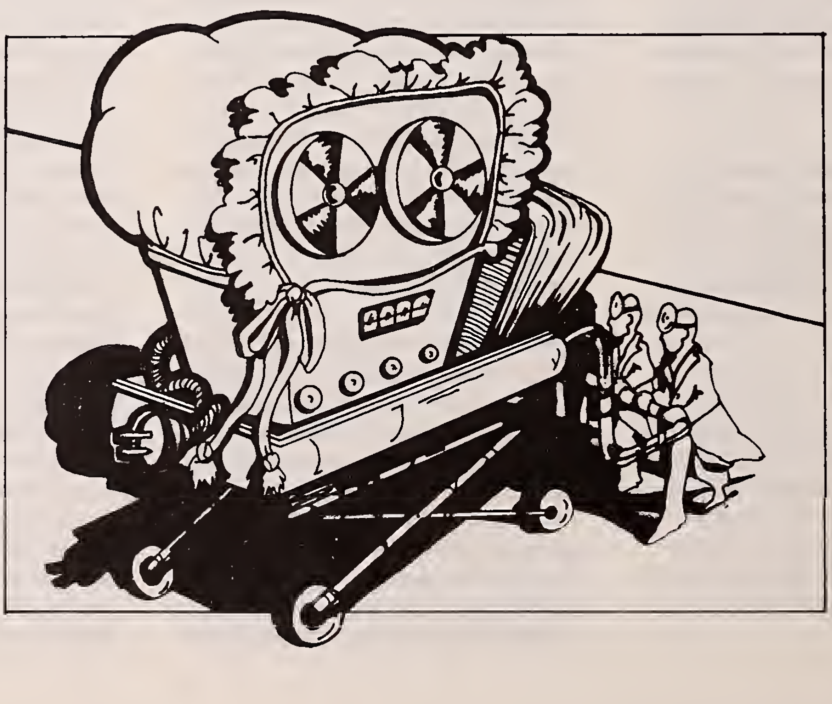
With manual information processing clearly in need of an overhaul, the remarkable advances that have occurred in computer technology have created interest in the possibility of automating the entire process. Computer technology is no substitute for the human brain, but it possesses two characteristics usually absent in human beings: a reliable memory and an ability to perform repetitious tasks at great speeds and without boredom or inattention.

The change from the vacuum tube to the transistor-integrated circuit and the mass production of minicomputer components have been associated with a widespread dissemination of computer technology. Less than thirty years ago, computers were both scarce and gigantic contraptions, costing in the million dollar range and requiring the electrical power of a locomotive. Today there are hundreds of thousands of computers that quickly and accurately perform all sorts of mathematical and scientific wizardry; the smallest model, costing only several hundred dollars, would fit in a shoebox and consume no more electricity than a light bulb. The increase in speed, memory capacity, and reliability of the machines and the more dramatic reduction of size and cost should continue for at least another decade.

Nevertheless, the use of computer technology in medical practice is in a primitive stage. At present, the only comprehensive use in hospitals is in financial operations, where the tasks are generally well-defined and consistent. The complexity of medical information processing has been poorly appreciated by the computer industry. Many computer-based hospital information systems are exorbitantly priced and their clinical application is principally confined to communication of orders and reports, such as laboratory test reporting, hospital census, and radiology scheduling.

A number of efforts are in progress to widen the base of the computer in clinical medicine. Direct recording of medical data and progress notes is one. In contrast to the relatively free-format handwritten notes, computer processing requires highly structured information stated in a predefined vocabulary. Thus far, it has not been possible to create a computer-based method of capturing medical data that combines both verbal detail and flexibility. Nor has it been possible to duplicate the handiness of clipboard records or the doctor's order book. Although when using a computer system to enter an order, the physician can be given immediate feedback — for instance, the completeness or inappropriateness of a medication order can be measured by the prior information on a patient in the computer-based record.

The computer can serve as a resource to physicians in the interpretation of clinical signs or in the choice of therapies. Knowledge-based systems include programs to aid in the selection of antibiotic treatment for bacteremia, to evaluate acid-base abnormalities, and to assist in the differential diagnosis of congenital abnormalities of the newborn. The specification and programming of such systems have proved difficult because medical technology is not standardized, and the diagnostic relevancy of medical data is often expressed imprecisely — a sign is "sometimes" or "rarely" or "frequently" observed in a particular disease. In addition, the diagnostic process involves



more than a simple association of a set of signs and symptoms with a disease classification; the diagnosis and its recommended therapy must be considered in context of the patient's circumstances. Intuitive judgments and computer techniques are incompatible, especially when the information available is incomplete, ambiguous, or partially contradictory.

To facilitate medical decision-making, however, computers can accumulate clinical experience on similar patients rather than merely produce textbook definitions. These experience-based systems presuppose a large data bank on the manifestations of a particular disease in many patients, the therapies used, and the outcomes. Data banks that are now being compiled on coronary-artery and rheumatoid diseases should help physicians in the choice of treatment.

The major constraint in developing these systems is not computer technology, but rather the effort expended in putting together a complete and systematic record on selected patients. Data is recorded on paper forms, which must be completed by the attending physician or by nurses trained to review records. But medical personnel do not have the time to devote to this laborious process. Expanding data banks will mean eliminating the need for duplicate paperwork. One solution is to enter routine medical data in a computer system that then automatically adds it to the data bank.

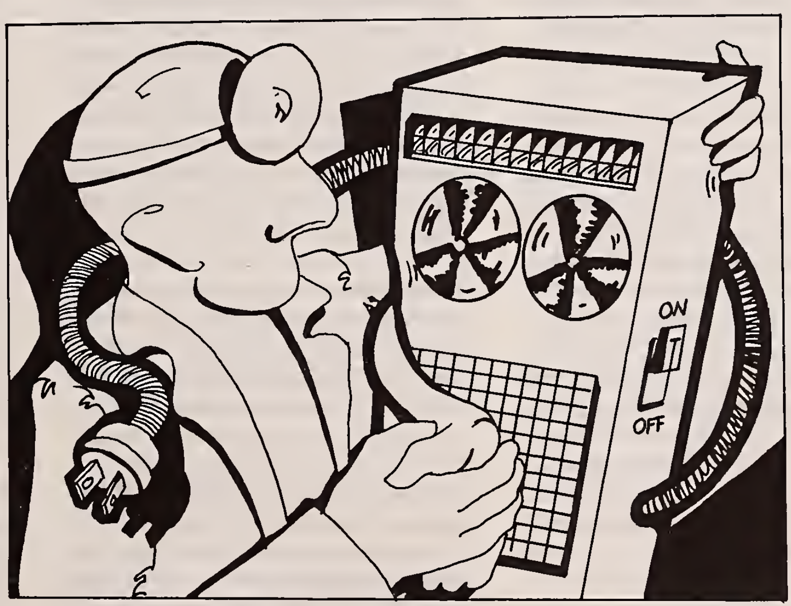
Although the main focus has been on improving patient care, a few centers are experimenting with computer programs that help train medical students and assist in the continuing education of physicians. An exciting application is teaching clinical problem solving by presenting a simulated situation, and then asking students to interact with the computer and gather additional information, make a differential diagnosis, and choose appropriate therapy.

Computer simulation addresses an important issue of medical education, namely, giving students adequate exposure to the variety of clinical problems that they may encounter in the future. Patients do not come to a teaching hospital or clinic in an idealized, textbook order; neither can physicians — for didactic reasons — control the stage that an illness has reached or alter the balance between unique and "interesting" cases, which usually abound in teaching hospitals, and common illnesses.

Medical students have little experience with emergencies and split-second decisions or with the crucial choices inherent in the long-term treatment of some patients. An instructor cannot allow a student to make an error and then to observe the unfortunate consequences. The student must accept the instructor's judgment that certain actions would be hazardous or inappropriate and others beneficial. Computer simulations, however, enable practice in clinical problem solving: the student assumes total responsibility for diagnosing the illness and managing the disease. The computer can either point to errors or weaknesses, or allow the student to observe a deterioration in the "patient's" condition as a result of improper management.

In both initial and continuing medical education, computer-based simulations offer certain advantages in comparison to a lecture:

- The focus is on problem-solving, rather than on cognitive information;
- the student has an active role, which is an important factor in learning new ideas and skills;
- the passage of time can be simulated, so that the student can observe the evolution of a disease;
- computer simulations can span a wide variety of complications and programs can be made increasingly difficult as the student becomes more adept. In addition, by challenging all students with the same case, com-



puter programs can provide standardized evaluations of clinical problem-solving ability;

- the opportunities for ongoing education are dramatically increased by computer technology, since a telephone communications network is universally available. The practicing physician chooses the subject matter and studies it whenever convenient. The initial cost of programming the simulation is higher, but once prepared, the unit cost can be lower than that of a lecture, particularly if the program is widely disseminated.

It is difficult to predict the future impact of rapidly evolving technology, particularly in medical care, which is in a period of transition and subject to new and powerful societal and governmental forces.

However, the following observations seem in order. The effects of computer technology on the structure, economy, and customs of society may be as significant as the introduction of new forms of energy production, precision machine manufacturing, and capital management on western culture that characterized the Industrial Revolution of the eighteenth and nineteenth centuries. Perhaps the twentieth century will be known as the age of the Computer Revolution.

Medical care and education are inherently information processing activities. Not only are manual techniques often grossly inadequate and wasteful of professional time, but it is unlikely that they will improve.

The combination of the power of technology and the magnitude of the need suggests a great potential for improving the information processing in medical care. The realization of this potential is limited by technological capability and cost, and more important, by the difficulty of defining needs in precise and quantitative terms. Much of the practice of medicine critically depends on human intuition and interaction, and the computer must not be allowed to distort these humanistic elements. Effective use of computer technology in medicine remains a major challenge to our imagination.

To pinpoint what HMS is doing to advance the cause of the computer, the Bulletin *consulted Drs. Barnett, Bleich and Slack in their respective workplaces — the Laboratory of Computer Science at the Massachusetts General Hospital and the Computer Medicine Laboratory at the Beth Israel Hospital. It is no surprise that all the Harvard teaching hospitals use computers to keep their accounting departments in order, and clinical applications for laboratory tests and other patient data are becoming increasingly commonplace in some of these hospitals as well. Major research units in computer medicine are located at the MGH and the BI. We learned something of the innovations in both hospital services and medical treatment that these two facilities are helping to bring about.*

"Talking back" to the computer

Two of the early believers in the potential of the computer to medicine were John H. Knowles and Robert H. Ebert. In 1964, when Knowles was director of the Massachusetts General Hospital and Ebert chief of medicine, they took a calculated risk and created the Laboratory of Computer Science. They asked Octo Barnett '56, a self-admitted physician/computer hobbyist, to be its director and initiate a research effort in the application of computer technology to health care. Breaking into a broad smile, and with a trace of a southern accent, Barnett says this makes him one of the "graybeards" of the field.

He came to the MGH from the Peter Bent Brigham Hospital and MIT, where he had been working on mathematical modeling of the cardiovascular control system. During his medical school and residency years he found himself gravitating to a small group of MIT professors and graduate students who were among the early disciples of computer technology. What started out as an intellectually stimulating avocation ended up competing with his career as a cardiologist. "It was not a conscious decision to go into computers," tells Barnett, "but a chance to do something unique and interesting."

As he then saw it, the notion of immediately developing a total hospital information system, whereby a large, central facility would support all the different medical activities was not feasible. Instead, he conceived an "incremental, modular approach" that focused on limited and well-defined objectives. To do this, the laboratory created a high-level computer language that could effectively manipulate textual data and could be used on a relatively small computer. This language, known as MUMPS (Massachusetts General Hospital Utility Multi-Programming System), was an impressive first step and has been adopted by many different computer manufacturers in the United States, Europe and Japan.

The concept of applying computer technology to the medical sphere has been disconcerting initially to many physicians, but Barnett's own medical credentials and his understanding of their concerns have helped ease their misgivings. "We try to be sure the system has obvious advantages, so that they will perceive the changes as acceptable because they are coming out ahead." Among the first information systems developed at the MGH were for the chemistry and bacteriology laboratories and the radiology scheduling and file control. The laboratory has gone on to set up computer systems for a number of the "communication activities within the hospital," including the hematology laboratory, the blood bank, the tumor registry, the pathology department, the utilization review activities, and the department of radiation therapy. In each case, the user has been deeply involved in defining the system and the functions to be performed. The LCS hopes to have information systems operating in all of the MGH laboratories by the end of 1979. The credit for the development work, according to Barnett, should be given to the staff of the LCS, which is one of the brightest and most competent computer groups in the nation.

Alongside this pragmatic work, the research mandate of the laboratory is being carried forward. When former Dean Ebert proposed an experiment in prepaid, ambulatory health care de-

Octo Barnett: building blocks for a hospital management system

livery, a logical adjunct was to provide a data information system. The result was COSTAR (COmputer-STored Ambulatory Record), one of the most well-known accomplishments of the laboratory. Barnett emphasizes that the environment of HCHP was conducive to integrating computer technology. Trying to superimpose computer techniques on an organization with established patterns can be difficult, but HCHP offered a chance for medical personnel "to grow with the system." The conventional medical record does not exist at HCHP; a centralized computer data base is the source for all patient information, as well as for all administrative tasks — management reports, statistical analyses, and enrollment demographics. "COSTAR is used everyday by the medical staff," says Barnett, and there would be strong physician reaction if it were taken away."

One of Barnett's criteria for the success of a given computer application is the willingness of the user to pay for its operation, once the research and development phases have been completed. HCHP agreed to assume the full financial obligation of programming COSTAR in 1977 and now operates the system independently.

COSTAR is the prototype for a generalized and comprehensive ambulatory medical information system that will be used beyond the confines of a "tightly administered" health maintenance organization. Working with the National Center for Health Services Research and Digital Equipment Corporation, the Laboratory of Computer Science has devised a new COSTAR system which will be marketed nationally. There are now seven COSTAR test sites; the largest is a group practice of thirty physicians on Vancouver Island and the smallest a group of five internists in Washington, D.C. The MGH is providing the programming support for only two — a group practice in Farmington, Maine, where the object is to deliver good medical care to a rural area, and the Urban Medical Group in Boston, where the emphasis is on community and home health care.

"We know that COSTAR works," says Barnett, "but we have to find out whether it can be made general enough to be installed in different sites without a costly amount of programming and support." According to him, one of the unique advantages of COSTAR is that it can automatically monitor the kind of care being given, based on standards developed by each medical practice. The computer system can detect deviations from these standards and notify the provider. Barnett views COSTAR as having an exciting potential to improve the quality of care in ambulatory practices.

The COSTAR project is not the first effort at applying the research done under the auspices of the LCS to practical problems. An important concern of the laboratory has been the use of the computer as a teaching device for medical education at all levels. The first computer simulations to teach and assess clinical problem-solving skills were developed in 1969. In 1972, the MGH joined with Ohio State University College of Medicine and the University of Illinois in an experimental health education network. Since 1975, MGH and Ohio State have been running the network without government support with MGH supplying computer programs of clinical content, primarily for third and fourth year medical students. The MGH programs provide continuing medical education as well, which has been approved for AMA Category 1 continuing education accreditation (as well as accreditation by the American Academy of Family Practice and the American College of Emergency Physicians). Some fifty universities and hospitals are hooked up to the time-sharing system via telephone lines that connect the user to the main computer in Boston. "We are very pleased," comments Barnett, "that we have become somewhat of a university without walls." The lab is now formulating a plan in which a manufacturer will furnish the actual computers to the different locations and the MGH will periodically send out the various programs — "like a book-of-the-month club."

Barnett views the computer as primarily a facilitating technology — supporting the information processing that is the core of medical care, but not changing the essential functions or relationships of the members of the health care team. However, the computer is still not totally acceptable to physicians, and their attitudes can sometimes jeopardize particular technological innovations. One example is the automated medications system designed to be used directly by the physician in creating and scheduling medication orders — with the computer actively contributing to the protocols. It was used on an experimental basis for over a year in one of the MGH's medical care units. The evaluation showed that the system made appreciable improvements over old methods. But technical difficulties and troubled physicians, who thought that their roles were being drastically changed, forestalled permanent implementation. Barnett acknowledges that the system may have been too radical a change. He also believes that

"head-on confrontations where somebody wins and somebody loses" are no answer either.

At present the laboratory is taking an alternate route to providing computer support for the doctor's order, which entails the development of a computer system that will be used by the pharmacist in recording the medication orders. To overcome the physician's latent prejudice, terminals that provide laboratory results are being placed on the various care units. "Our expectation," explains Barnett, "is that as physicians perceive computer systems to be increasingly useful, and as we develop more powerful computer technology, the medication system will evolve to the point where the transcription process is replaced by the doctor entering the order directly into the computer."

For the interim, Barnett is satisfied with the progress of the laboratory in putting together a large, comprehensive information system, although he says that it is hard to envision what the ultimate system would be. Eventually, he expects that information from the various distinct "modules" will be uniformly available for activities throughout the hospital; current efforts of the lab are directed toward developing a common language that will allow the user to obtain information from these different modules. "You don't try to force an integrated information system on a hospital that isn't integrated. We believe in a hill-climbing approach — you climb one hill, then you see where the next one is. You climb the mountain by first climbing the hills." For a large, and rather decentralized hospital with numerous departments and divisions like the MGH, this approach seems only sensible.

"Good morning, Mrs. Burn. It's good to see you. Now what seems to be the problem?"

"Good morning. Lately, I've been feeling listless and I seem to have little appetite. I feel fatigued nearly all of the time and am having trouble concentrating."

"That doesn't sound good. Let's find out some more about your exact symptoms. When was the last time you felt like this? . . ."

Such dialogue is the usual stuff of a patient interview, except that in the future this kind of exchange may take place between patient and computer. Visions of automated medical care dance in your head? The prospect lies ahead. For now, exchanges between computer and patient cannot duplicate a free-form conversation. But by dint of its memory capacity and an ability to "think," the computer can interact constructively with patients. At the Beth Israel Hospital, the challenge of demonstrating the potential benefits of computer technology to patient care has fallen to Howard Bleich, M.D. and Warner Slack, M.D., an easygoing pair of colleagues who together direct the department of computer medicine.

In ten years of setting up hypotheses, collecting data, and evaluating the results, Slack and Bleich have studied the possibilities of the computer in medicine and how far certain techniques can be pushed in "isolated pockets" of medical knowledge. The two men have different though complementary research interests: Slack, whose training is in neurology, has worked on computer modeling of the physician as an interviewer, mainly in an outpatient setting. Comments Bleich, "Warner was the first person to put a patient in front of a computer terminal." Bleich has explored the ability of the computer to interact with physicians and to provide them with information on patients with complicated medical problems. He has developed consultation programs for the clinician at hospitals with no reservoir of specialists. Reflecting his training as a renal specialist, he has concentrated on problems of the acid-base balance and fluid electrolyte disturbances, but clinical problem solving programs have also been devised for hematology and some areas of dermatology. Furthermore, several of his programs are described in courses offered through the health education network that is cosponsored by the MGH.

As collaborators, each shares in the other's projects. Slack explains the framework of much of their work: "Laboratory results and other types of clinical information are entered into the computer, which queries the doctor for more information, making decisions on the way. It eventually generates suggestions for the physician to follow in managing patients' problems." The consultation programs designed by Bleich are a departure from other computer strategies available to medical personnel. Slack explains why. "Howard's work was truly radical and innovative in that the doctor was offered practical suggestions for treatment."

The aim of their research projects is to learn the fundamentals of how computer techniques might be beneficial to patient care. For the forseeable future, Bleich and Slack believe that patients and computers will exchange views mainly in a controlled research environment. In the development phase of this work, the patient's perceptions have been crucial. Patients are asked to read questions aloud, explain them, and criticize their content. Their suggestions and criticisms help improve the style and content of the programs.

Once a program is operational, patients receive a copy of the summary which, with their permission, can also go to their doctor. "A number of patients have commented that they like the neutrality of the computer, the fact that it's non-judgmental." Slack feels that computer interviews may let patients describe personal problems more freely than in the traditional doctor-patient encounter. "Physicians so often communicate how they want their patients to answer, and patients are highly motivated to please. Patients will frequently indicate a preference for the computer when answering personal questions, even though they want their doctor to know their answers. Our philosophy is that patients who want to should be able to take control of their clinical destinies. For that reason programs have choices like 'none of your damned business,' toned down to 'skip-it' in the Boston area."

Warner Slack and Howard Bleich: patients are their best resource

Computers not only collect and store patients' medical histories, but recently some programs have been created that offer strategies for making patients more responsible for their own health. A current project of the computer lab involves collaboration with the department of nutrition at the School of Public Health in a dietary program for men who have hyperlipidemia. Interactive programs may help them change their diets and, as a consequence, lower their levels of cholesterols and triglycerides. The educational possibilities of interactive dialogue should not be underestimated; patient education has never been a forte of the physician.

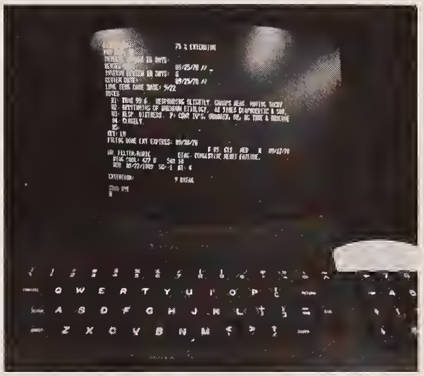
At first the idea that patients would answer questions asked of them by a computer was given little chance of success. Thousands of patients have been tested and the initial positive feedback quickly proved the cynics wrong. The next hurdle was to find whether the many facets of a medical problem could be explored using computer techniques. Based on general questionnaires, it was shown that computers could conduct complex branching interviews. When the reach of computerized history-taking was extended to specialty areas such as allergy, gastroenterology, gynecology, and dermatology, Bleich and Slack sought guidance from specialists.

In the last few years, their programs have been exported to other medical centers, including the University of Wisconsin, University of Alabama, and Ohio State. Some hospitals have taken the concept and devised their own interviewing techniques. Closer to home, computer terminals located in clinics, such as the Harvard Street Clinic in Dorchester, communicate directly with the Beth Israel computer. (Because of the high proportion of immigrants in that area, programs are offered in Haitian French and Puerto Rican Spanish as well as English.)

The various studies have not proven that a computer interview is superior to that done by a physician, but certain advantages do exist. Slack and Bleich were pleased to find that the computer is fun for the patient, and in terms of collecting the information, the computer never forgets. As Slack puts it, "The machine may break or stop, but the likelihood that it would bypass a question that it had been programmed to ask is infinitesimal. Reliability and memory of this type are not fortes of the human mind. The detail with which a human can conduct an interview is, however, hard to rival." They emphasize that a causal relationship has not been established between interactive dialogue and improvement in the recovery rate or in the quality of medical care. But they are encouraged by the progress of these studies and the patient data.

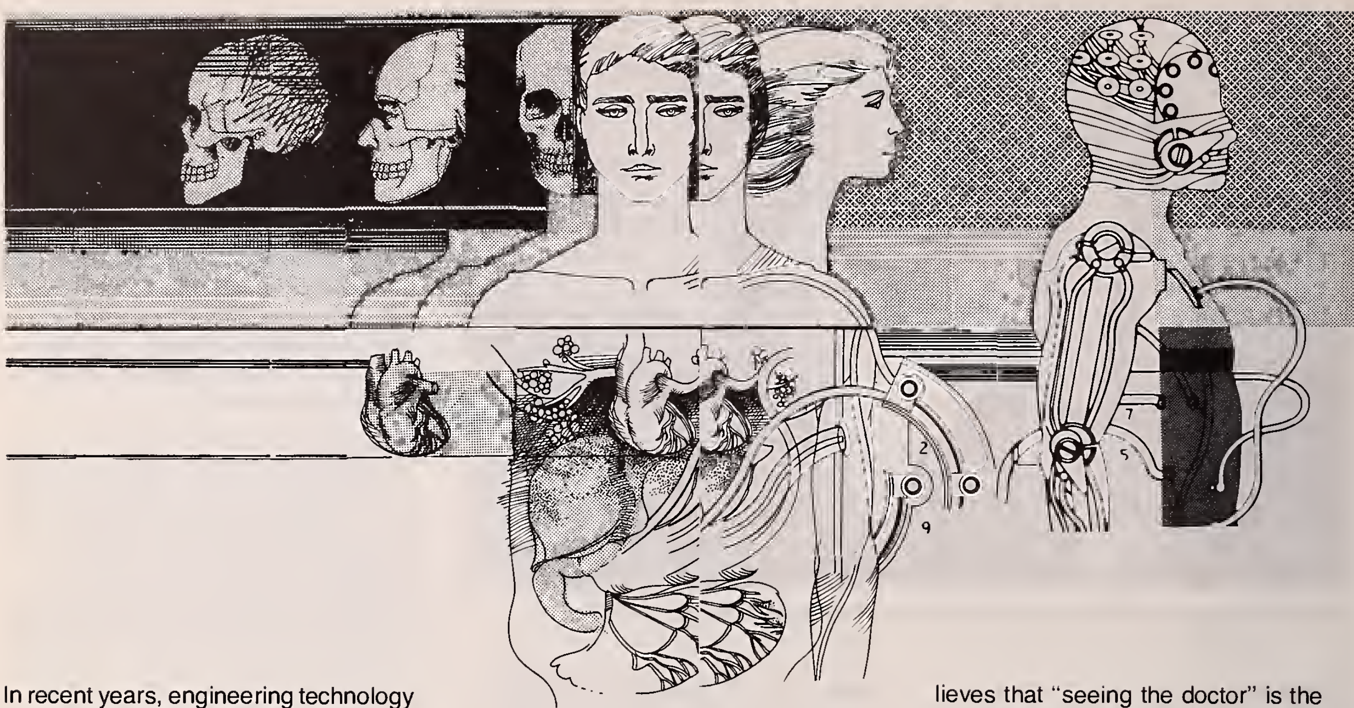
Beth Israel patients have been deriving the benefits of this resourceful computer facility that is continually working toward reducing waiting time, confusion, and cost. Computer programs have been designed for such hospital activities as patient registration, locating and tracking medical records, scheduling appointments, assigning beds to patients and nurses to floors. In addition, a utilization review system has simplified compliance with the labyrinthine federal regulations that require hospitals to produce immense administrative documents on selected patient populations.

Altogether some sixty terminals are synchronized with one another, so that patients answer routine questions only once. Basic medical data is immediately available (via electronic transmission) to whichever department needs it. "All sorts of paper that used to shuffle around the hospital has disappeared," says Bleich. Beneath this "megaproject of the lab" may lie the answer that he and Slack are eager to hear — that computer techniques are more effective, but not more expensive, than manual ones.



They see successful hospital applications for a wide range of services as paving the way for introducing the computer's clinical problem solving capabilities to actual medical care. Building upon existing hospital systems in this manner may eventually render the pressing question of cost effectiveness academic. Bleich and Slack are sanguine that when they no longer have to prove that the technology is unequivocally worth the expense, the computer will stand on its own merits.

— Deborah Miller



Choosing our means

by Ernest G. Cravalho

In recent years, engineering technology has penetrated increasingly the practice of medicine and become an indispensable part of its fabric. Yet impressive scientific and technologic achievements in medical care that have raised the expectations of the American public have been accompanied by mounting anxieties over the cost and accessibility of health services.

Cost has tended to monopolize public attention. Recall its importance in the recent coal miners' strike. The owners wanted the miners to pay a little more of their medical costs; the miners refused and made that issue one of their three demands for settling the strike. On a national level, the expense of health care has risen from $12 billion in 1950 to approximately $160 billion in 1977, and accordingly, that percentage of the GNP has increased from 4.5 to 8.6 in the same period.

The growth of technology is but one source of increased medical costs. As Lewis Thomas and Ivan Bennett separately point out, there are extenuating factors, notably the "cost of worry in the health care system"[1] and the "cost of defensive medicine."[2] Despite general improvement in their health, the American people have come to believe that the human body is "fundamentally flawed, subject to disintegration at any moment, always on the verge of mortal disease, always in need of continual monitoring and support by health care professionals."[3] Influenced by the extraordinary attention given to health in the media, the public has become vigilant for "danger signals" and believes that "seeing the doctor" is the only means to obtain reassurance that all is well.

Equally important is what Bennett calls the "Marcus Welby syndrome."[4] Successful dramatizations have insidiously encouraged television viewers to expect miracles of medicine, so that in the real-life situation when a "happy ending" fails to occur, malpractice is frequently suspected. This perception has sometimes created an adversary relationship between physician and patient. Fear of litigation has forced many physicians into the practice of defensive medicine in which every available technology, whether necessary or not, is employed. Obviously, this approach leads to its overuse, particularly in diagnosis. But these factors do not make any less significant the fiscal impact of introducing new technology into medical practice.

Definitive technology can prevent or cure disease at modest cost in contrast to *halfway technology,* which palliates illness based on a partial understanding of pathogenesis and may result in extraordinary costs — both social and financial — for the treatment of chronic disease.

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The symbiosis of medicine and technology forces a consideration of these issues in all their manifestations. To do this comprehensively, a formalized process is being devised — known, for want of a better description, as "technology assessment." This term, in the present state of the art, means different things to different people, and no single discipline is devoted to its study. However, there are several key perspectives from which the process can be viewed, among which are the impact of the technology on the patient, the patient's family, the health care and legal systems, and on the political and economic forces at work in our society.

From the patient's perspective, technology assessment should examine precisely how his or her life will be improved through the use of new modalities of care. In some cases the new technology may sustain a situation that may lead only to a lingering, unproductive or even painful existence. The probabilities of such outcomes must be evaluated as accurately as possible, and factored into the process by which the means of health care is chosen.

For the patient's family, an assessment must address short and long-term repercussions of the new technology and its potential impact on family structure. Use of some technologies may present implicit physical and psychological hazards as well as require the active assistance of family members over an extended period of time. The burdens must be carefully evaluated and compared to those encountered in alternative therapeutic strategies.

One must consider how social values might influence development, acceptance, and use of the new technology, and the reciprocal effects of the technology on these values. From the viewpoint of the health care system, any assessment should consider the impact of technology on personnel, equipment, and facilities. If special means are required, they must be identified in advance, together with their costs, and evaluated in light of competing bids for the same resources. Assessment must clearly establish whether a new device is a *substitute technology* that will replace existing instruments, reduce expenditures, and improve efficacy, or an *add-on technology* that will allow something new and extra to be done, but only by increasing overall costs. Unlike other sectors of society, in the medical community the "user" of technology is the physician, not the patient. In the future, technologies themselves may have to be conceived with particular value judgments already in mind. Deciding who gets the technology is imperative. Finally, it must be determined whether existing professional and legal regulations governing medical care need to be modified.

The legal dimensions of a new technology can be significant. Redefinitions of liability and the nature of informed consent may emerge. Moreover, even the legal status of death or suicide may be subject to reinterpretation, as has happened at least once in the past decade.

In economic terms, the assessment should consider (in addition to cost) a new technology's influence on disability programs, life insurance, pension funds, and the Social Security system. The role of the federal government in helping to subsidize the costs of technology must be examined, as well as the market forces that might promote widespread usage and the impact on the nonmedical sectors of the economy, including the job market.

These are some of the issues that technology assessment incorporates. Superimposed on all of this are broad questions concerning the assessment process itself:
- When is an assessment of technology necessary?
- Who is responsible for it?
- How comprehensive should it be?
- Who should bear its cost?
- Who develops the necessary data base and how are the data gathered?
- How should the assessment's results be used?

Developing the ability to cope with these questions should be a part of the educational process of all health care professionals, but sadly it is not. To be sure, most medical schools have introduced into their curricula subjects on medical ethics, but few, if any, have attempted to examine the broader, more substantive issues that comprise any meaningful assessment of technology. The Harvard-MIT Division of Health Sciences and Technology has attempted to do so in developing its new doctoral program in medical engineering and medical physics by including courses in technology assessment and medical ethics.

It is the belief of the faculty involved that these medical engineers and physicists who will be responsible for developing many of the diagnostic and therapeutic technologies must also play a significant role in their assessment. Furthermore, such evaluations must be carried out prior to the clinical implementation. In choosing the means of health care, the physician and the patient must be fully aware of the costs, the risks, and the likely benefits. But first, the developers of health care technologies must contribute to the requisite data base that will allow a fair and comprehensive evaluation to take place.

References

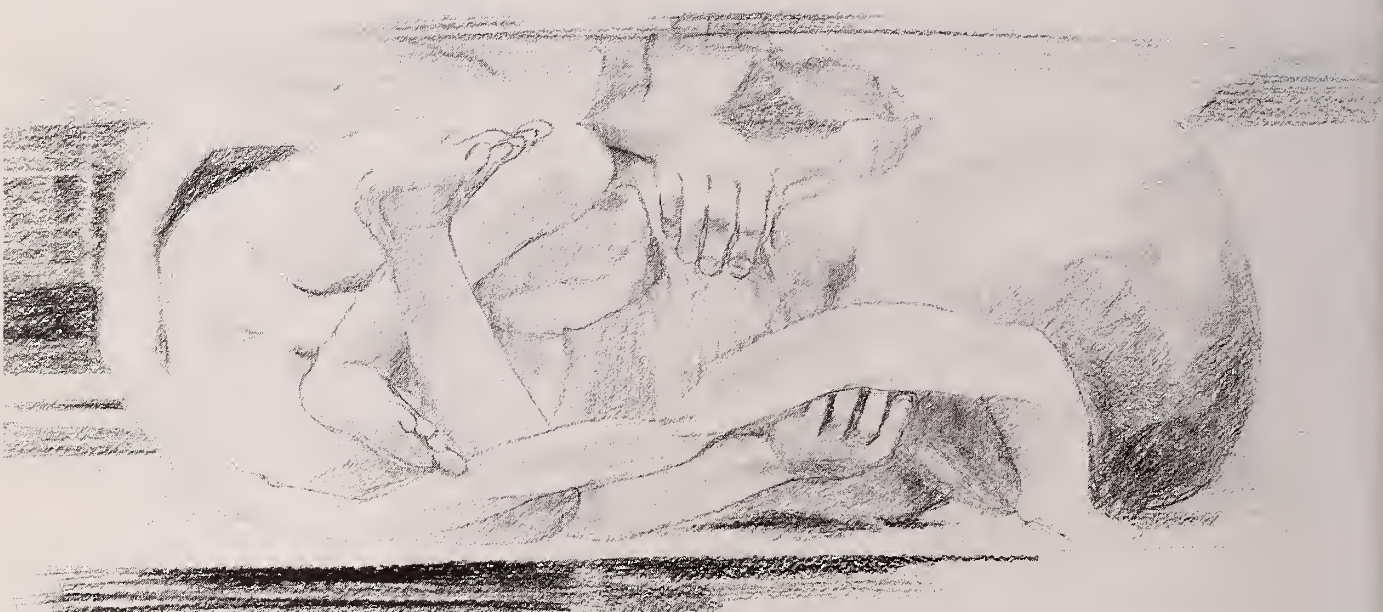
1. Thomas, Lewis, "On the Science and Technology of Medicine," *Daedalus*, Vol. 106, Winter, 1977, pp. 35-46.
2. Bennett, Ivan L., Jr., "Technology as a Shaping Force," *Daedalus*, Vol. 106, Winter, 1977, pp. 125-133.
3. Thomas, p. 43.
4. Bennett, p. 132.

Additional Sources

"Scientific and Educational Basis for Improving Health: Report of the Panel on Biological and Medical Science of the President's Science Advisory Committee," Office of Science and Technology, 1972.

"Improving Health Care through Research and Development: Report of the Panel on Health Services Research and Development of the President's Science Advisory Committee," Office of Science and Technology, 1972.

"Development of Medical Technology: Opportunities for Assessment," Office of Technology Assessment, U.S. Congress, 1976.

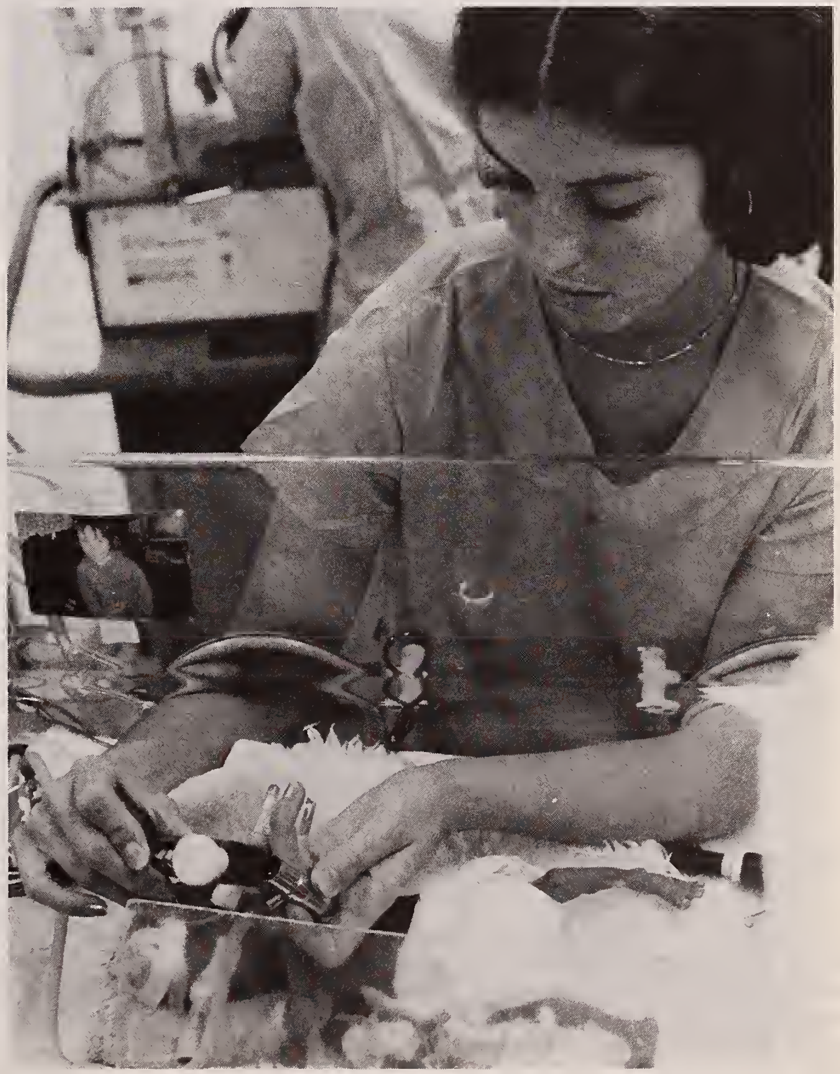


NEONATAL INTENSIVE CARE: "INCOMPLETE SOLUTIONS

Neonatal intensive care: "incomplete solutions"

by H. William Taeusch and Mary Ellen Avery

At a recent grand rounds at Children's Hospital Medical Center, a lively two year old child with short bowel syndrome was presented. Her entire life has been in the hospital. After removal of most of her diseased small bowel when she was a newborn infant, she has lived and grown with almost all nutrition being administered intravenously. In recent months some progress towards normal feeding has been made, but her long term future remains uncertain. Introduced to the grand rounds' audience, she was seen to be a charming, outgoing and sociable child. Judah Folkman '57, professor of surgery at Harvard Medical School and chief of surgery at Children's Hospital, commented that the case illustrated an "incomplete solution" to a clinical problem. Ten years ago she would have died in her first year because of insufficient knowledge of intravenous nutrition. Now she has been kept alive, but only through an immense and costly effort by hospital personnel. A "complete solution" would have required immediate curative therapy for the short bowel syndrome, or better, prevention of the need for bowel removal.



Susan O'Toole, one of the intensive care unit nurses, attaches a respirator to a 900 g premature infant.

H. William Taeusch, Jr., M.D. is the director of the Joint Program in Neonatology, and associate professor of pediatrics at the Boston Hospital for Women. Mary Ellen Avery, M.D. is physician in chief at the Children's Hospital Medical Center and Thomas Morgan Rotch Professor of Pediatrics.

"Incomplete solutions" are familiar to those of us in the new speciality of neonatology. In 1978 a 900 gram infant born prematurely has a 42% chance of survival (Figure 1). Ten years ago the chance of survival was nil. But in order to survive, the very premature infant often requires three months of neonatal intensive care that can cost in excess of $100,000 due to high-priced equipment and the large number of personnel that are part of modern therapy.[1] For example, a single intensive care station comprises an incubator, respirator, monitoring equipment, and intravenous pump at a cost of $11,000, with complete depreciation over five years. (The equipment becomes outdated, worn out, or both in that period.) For every ten infants in intensive care, four full-time physicians, thirty full-time nurses and a panoply of consultative services as well as laboratory technicians, secretaries, and administrative support are required. Modern technology is adding almost daily to the expense of care as are ancillary services necessary to maintain the technology as well as the patient.

Table I

Level III Perinatal Center

1 Year Budget[2*]

I. Personnel		
A) Physician (11 positions)	$ 263,504	10%
B) Nursing (131 positions)	1,299,755	49%
C) Adjunct staff (18 positions)	149,190	6%
D) Consultants (12 positions)	—	—
subtotal	$1,712,460	65%
II. Expenses		
A) Equipment	$ 54,000	2%
B) Transport	66,240	3%
C) Supplies	232,112	9%
D) In service education	10,000	0.4%
E) Overhead	513,740	19%
subtotal	$876,092	33%
III. Perinatal Regional Education		
subtotal	$ 48,507	0.9%
Total	$2.6 million	100%

* Estimated costs to serve a population of 10,000 deliveries per year.

Two examples: As many as 40% of infants born weighing less than 1200 grams (three pounds or thirty-one weeks gestation) may have an intracranial hemorrhage. Until computerized-axial tomography ($250,000/unit) was available there was no way of diagnosing this condition with certainty, premortem. Now many infants of less than 1200 grams birthweight receive a CAT scan since it is evident that their outlook is impaired after intracranial bleeding. The results of these tests may raise difficult questions concerning management. Should an infant with a serious intracranial hemorrhage be maintained on a respirator? Should the study be done and, if so, who should pay for it?

Continuous monitoring of oxygen tensions in the blood of sick infants has also become available either by indwelling arterial mini O_2 electrodes or by O_2 electrodes attached to the skin. Such information allows us to keep the infants in a better state than we could with intermittent measurements. These electrodes require another piece of equipment costing $10,000 per patient. How do we assess whether the cost is justified?

A global yearly budget for a perinatal intensive care unit (one including services for high risk obstetrics as well as newborn infants) has been estimated at $2.6 million (Table I). If such a unit could serve a population of 10,000 deliveries a year, (2,000 of these within the hospital itself) its cost would be $260 per birth. This figure could be viewed as the insurance necessary to keep optimal perinatal care available to that population. Such care is associated with a reduction in stillbirths and neonatal deaths, and a lowered long-term morbidity among low birthweight infants. Although objective measures of the magnitude of such reductions are not available, the national trend towards establishment of regionalized perinatal care indicates that those involved in medical decision-making believe the benefits to exceed the costs.

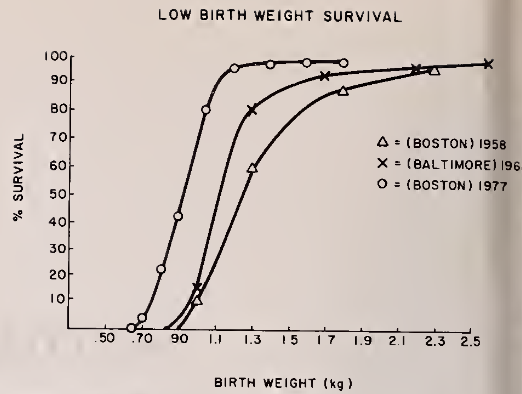


Figure 1. Birthweight — specific mortality rates over three decades. The limit of viability now appears to be about 600 g corresponding to a gestational age of about 24 weeks.

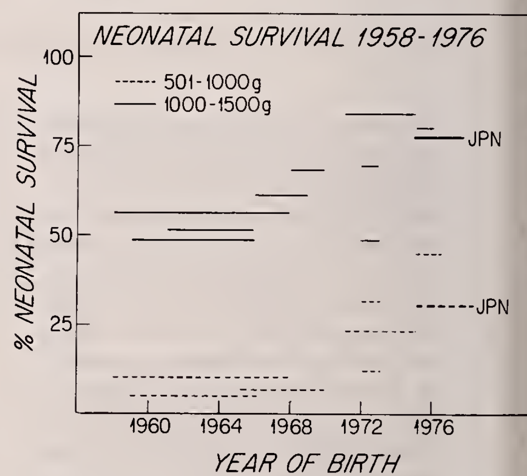


Figure 2. Mortality for two groups of low birthweight infants is shown according to the years in which the tabulation was carried out. The various horizontal lines represent different studies from the medical literature. JPN data from the Harvard Joint Program in Neonatology from 1975-77.

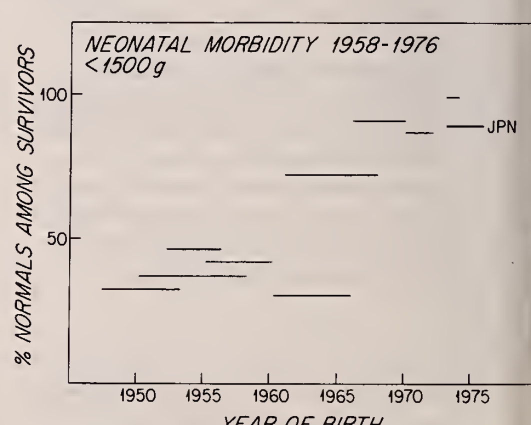


Figure 3. Decreasing morbidity among low birthweight survivors is illustrated when the 1970s are compared to the 1950s. Format as in Figure 2.

These expenditures, nevertheless, do need justification. Skeptics ask whether the same expenditures could achieve our purposes through a completely different approach. For instance, if most neonatal intensive care deals with premature infants, and prematurity is linked with poor nutrition during pregnancy, would a nutrition program for high risk mothers reduce the need for neonatal intensive care? Would programs to decrease teenage pregnancies, which contribute disproportionately to infants of low birthweight, have a similar impact? Should our resources be put into more basic studies of the reasons for premature onset of labor? We answer that such approaches are important and should be tried, but their impact depends on continued research. Meanwhile we need to maintain present services for high risk mothers and premature infants.

Are we saving lives of tiny premature infants only to increase the numbers of mentally retarded children with cerebral palsy? Fortunately, no. Survival for infants of very low birthweight has improved over the past fifteen years (Figure 2). The number of "graduates" of intensive care nurseries who are normal has also increased (Figure 3); a larger pool of damaged infants is not a necessary sequel of an improved rate of survival. Each decade we see a larger proportion of the total group of low birthweight infants surviving and developing normally (Figure 1). At the same time, a small group of infants at the borderline of viability is now alive, and impaired to different degrees. A major problem is that we cannot always distinguish such infants in the first days of life from those who may develop normally. The challenge is of course to optimize outcome for all who survive.

Given an acceptable rationale for neonatal intensive care units based on the numbers of lives saved, ways of decreasing costs without sacrificing quality of care have been investigated. At present, the most effective approach is regionalization of services. No more than three per cent of liveborn infants in Massachusetts needs neonatal intensive care. Thus, for the 65,000 livebirths each year about 2,000 infants require intensive care. Five neonatal/perinatal intensive care units exist in Massachu-

"With the advent of new intensive care services for infants, we keep discovering more and more specific moral questions."

A new incubator for weakly-born infants in a ward of the Maternity Hospital in Paris circa 1885.

Neonatologists have tried to balance the exigencies of medical technology with the all-important bonding that should take place between parents and child. Even though babies are in the intensive care unit, parents can be with them continuously, if they wish.

The intensive care unit at the Boston Hospital for Women, which was renovated at a cost of $400,000 two years ago. When this is at capacity, infants are taken to Children's Hospital.

Once the infants have survived the critical stage, they move into the intermediate area of the nursery. There they remain in incubators and are routinely taken out to practice breathing completely on their own (opposite). When they advance to open-air cribs in the recovery area, their leave-taking is near. Altogether, the infants may be in the nursery for a two to three month period before they "graduate."

setts, with approximately sixty-five intensive care beds and an average length of stay of fifteen days; these serve the statewide need with near maximal use. The more than forty community hospitals that deliver infants in Massachusetts have been active partners with these perinatal centers in fostering regionalization of services. The process has been aided by the Perinatal Welfare Committee of the Massachusetts Medical Society, which is attempting to implement a voluntary program to tighten communications between delivery hospitals and perinatal centers, as well as provide information on current practice to improve services. The state department of public health is trying to outline criteria that will define a perinatal intensive care unit.

With the value of intensive care units being carefully measured, the role of the hospital-based neonatologist becomes clearer. The image of warm-hearted technologists saving small premature infants before the eyes of stricken parents is attractive to some of us in the field and occasionally based on reality. However, as pointed out by Dr. Folkman, it can be an expensive solution both in human and financial terms; prevention, either of prematurity itself or of the consequences of prematurity, e.g. diseases such as hyaline membrane disease, must remain a major goal of research. The full-time neonatologist assumes responsibility for clinical investigations essential for further improvements in care. Promising advances in biomedical science deserve "field testing" in the nurseries, under the supervision of individuals trained to view each infant's best interests as their first priority. The neonatologist is the infant's general physician and primary caretaker in the intensive care nursery, coordinating the essential inputs from the many specialists whose skills may be needed.

The questions of how to reduce morbidity and mortality in small infants sometimes involve significant ethical dilemmas. Because all the various strategies for reaching the same goal are difficult and expensive, choices have to be made, and priorities established. At present the choice of a few centralized perinatal centers serving the needs of the many seems a useful compromise. Nevertheless, with the advent of new intensive care services for infants, we keep discovering new and more specific moral questions. Is it possible, for example, that attempts to save newborn infants with brain damage should not be made? What is one to do with the 500 gram abortus that makes gasping movements in a unit with the facilities to care for a 600 gram prematurely born infant, especially when there is demand from community hospitals for greater availability of neonatal intensive care beds for their infants? How can one defend extensive and heroic attempts to save an infant whose chances of survival are less than ten per cent and whose chances of survival without brain damage are less than two per cent?

Making these kinds of decisions probably appears more difficult to lay people and health care workers who lack direct experience than to physicians and nurses who constantly encounter such situations. While this could be construed as an argument for elitism, it may, rather, argue for expert opinion in situations requiring firsthand knowledge.

We have come to believe that a neonatologist is a most appropriate consultant to a serivce where an abortus may be born that approaches the limits of viability. Life and death situa-

"Our job as physicians is to follow a course based on reason, recognizing that in many specific cases, no person can know the right answer."

tions regarding respirator support are more easily judged on the scene than from an armchair. When the question of whether to persist with life support is unclear, a uniform process for making choices should be continually sought. There is general agreement that the strenuous maintenance of an anecephalic infant would be absurd; still, making both the infant and its parents comfortable under stressful circumstances is paramount. There is general disagreement on what to do when parents of an infant with Down's Syndrome refuse to sign an operative permit allowing corrective surgery for duodenal atresia.[3] Few agree as to the precise guidelines for starting respiratory management of the tiniest premature infant, or whether to persist (and for how long) after an intracranial hemorrhage has occurred.

Because many people feel that no one individual is wise enough to know the answers to these questions, an emerging trend is introduction of more people into the medical decision-making process: judges, everybody caring for the infant, or a hospital committee. In our view the best decisions are made when the final responsibility for choice is given to the attending physician, who has conscientiously conferred with all concerned, but mainly with the parents, nurses, and social workers, and one or two other physicians who (usually) represent other specialties.

The specific questions involving appropriateness of maintaining life or allowing death are becoming poignant as we rid ourselves of the "litter" concept of childbirth — that only the best (and a few) will survive infancy without disability when born prematurely. Perhaps our job as physicians is to reduce the dramatic aspects of these issues in the mind of the public, and to follow a course based on reason, recognizing that in many specific cases, no person can know the right answer.

Thus, the guidelines of 1978 may not be appropriate in 1979, and today's "incomplete solution" leads to tomorrow's complete one. How long to support the life of an infant with an inoperable heart defect is no longer an issue when corrective surgery becomes available. We can never expect to become comfortable with crisp mandates for action or inaction. Existence in a gray zone of decision-making is inevitable; equally inevitable are its changing boundaries. Wide acceptance of having to live with uncertainty could do much to alleviate the anxieties of physicians, nurses, parents and jurists. We believe that the judicial and legislative approach to these problems can be unresponsive and insensitive. Allowing the medical profession latitude in these areas will, finally, be to the benefit of the infants themselves.

1. Pomerance, J. J. et al: Cost of living for infants weighing 1,000 grams or less at birth. Pediatrics *61:*908-10, June 1978.
2. *Toward Improving the Outcome of Pregnancy,* Committee on Perinatal Health. The National Foundation-March of Dimes, 1977, Pg. 35.
3. A. R. Jonsen, S. J., Ph.D., R. H. Phibbs, M.D., W. H. Tooley, M.D. and M. J. Garland, Ph.D.: Critical issues in newborn intensive care: a conference report and policy proposal. Pediatrics *55:* 756-64, June 1975.
4. Figures 2 and 3 are adapted from Fuller, William E.: Management of Premature Labor in *Clinical Obstetrics and Gynecology,* E. L. Makowski (ed), Harper and Row, p. 533, Vol. 21, June 1978.

Being honest when technology fails

by Ned H. Cassem

Urs Peter Haemmerli, chief of medicine at the Triemly City Hospital in Zurich, a man of stature and impeccable credentials, was arrested at his home in Zurich on January 15, 1975, accused of murdering by starvation an unspecified number of unnamed elderly patients at his hospital. His accuser was a journalist whom he had told in an interview that patients in irreversible coma were maintained on saline and water alone.

Two years earlier the Critical Care Committee of the Massachusetts General Hospital was asked by representatives of the nursing service to examine an increasing concern of patients in our intensive care units — and their families — not that they would be murdered, but that technology would be carried too far in treating them. In short, they feared that technology would be used to prolong dying, thereby inflicting further suffering and diminishing the patient's dignity — a misuse of technology for inhumane ends.

Physicians have always learned that their two most basic obligations to their patients are to relieve suffering and to restore health. Because the technological devices to pursue the latter can also inflict suffering, these two goals may conflict as a patient gets sicker. We have blood and blood products, cooling blankets and incubators, hormones and their antagonists, total nutrition available by vein for those unable to eat, mechanical ventilators and the extracorporeal membrane oxygenator for failing lungs, dialysis for failing kidneys, and pacemakers, defibrillators, the intraaortic balloon and the left ventricular assist device for failing hearts — not to mention myriad drugs and indefatigable monitoring devices for any and every orifice to scrutinize movements of the body's organs, cells and even cell fragments. Even though physicians are blessed to have such a wide array of therapies to choose from, they are always likely to be criticized by the public — some damn us because we do use the above means, others damn us because we do not.

Ned H. Cassem '66, S.J. is an associate professor of psychiatry at the Massachusetts General Hospital and chairman of its Optimum Care Committee.

It would perhaps be easier if there were no choice. In fact, one occasionally hears the argument that we *must* use all the technology available whenever we treat an ill person. Yet if we use equipment merely because it is available, it is we who are used by the equipment, not the equipment by us.

Rhetoric notwithstanding, the Critical Care Committee set up a subcommittee to examine these questions as experienced at MGH. Constructing the subcommittee presented another dilemma: how could we make sure that all the various "interests" of the hospital were represented and yet have any sort of functional group? The number was deliberately kept to a minimum and included a psychiatrist as chairman (myself), an oncologist (Rita Kelley), a general surgeon (George Nardi), the nursing supervisor of all the ICU's (Sr. Kateri), the hospital lawyer (James Vaccarino), and a patient (Mildred Badnek), a woman who had undergone a shoulder disarticulation at MGH for a rare and highly malignant bone tumor. Besides being a psychiatrist I am a Jesuit priest with formal training in ethics; the nursing supervisor is a religious sister (Sr. Kateri); and the patient is a physical therapist at another hospital. Of the members, three are women, three men; five are white, one is black. Specialties were somewhat important in the selection of these individuals, but the most important criterion was the wide respect and trust they enjoyed in the hospital and their ability to get along well with others.

In its earliest phase the subcommittee observed, gathered information, and discussed clinical problems that were judged particularly difficult. "This man is not going to get any better. We're not helping him. Where or when do we stop?" Our subcommittee was first given the rather gruesome title "Subcommittee for the Utilization of Facilities for Hopelessly Ill Patients" because the common denominator of all the problem cases was a patient whose illness was irreversible in *somebody's* eyes. Sometimes this was the view of the patient's doctor, at others it was the view of the family, the nurses or a consultant physician. Whoever became convinced that treatment could not make the patient better, worried that it would be injurious and was needless "torture."

Within its first year, the subcommittee changed its name to the Optimum Care Committee and could be consulted by the primary physician in any case where a patient's illness seemed irreversible and the question of appropriate treatment was raised. Let the reader note carefully that decisions are not dictated by the committee. Physicians request the consultation and recommendations are made; but the primary physicians write the orders and take responsibility for the decisions.

One of the myths held early on by the physicians was that the nurses were "playing doctor" (claiming that patients were being overtreated) and likely to seek consultations for spite rather than for clarification. In fact, only the primary doctor could ask for the consultation, just as other consultations are requested by the primary physician. However, the nursing staff was occasionally able to prevail on the primary doctor to request committee involvement.

One early consultation was hesitatingly requested by a surgeon convinced that the ICU nurses were trying to usurp his responsibility; they worried that his patient was irreversibly ill and thought their application of ICU technology was more abuse than treatment. When the nurses were asked why they were convinced of the prognosis and in conflict with the surgeon, they revealed that the surgical intern and resident made frequent comments about the patient like, "What a waste of time," or, "This is just a warm autopsy." Since they were in effect performing twenty-four hour resuscitation on this very sick woman, they were demoralized by such remarks, concluded their efforts might be meaningless, and pushed for some honest clarification and resolution.

Communication stands out as the most basic antidote to the hostility and accusation which can surround treatment of patients with irreversible illnesses. Tranquility is not a common companion of tragedy in the general hospital. An only son, in a coma from an automobile accident, is transferred to the MGH to see whether there is anything the hospital can do to restore his function. One family member fears that the hospital will give up efforts too soon, while another fears that the neurosurgeon, knowing recovery is out of the question, will "experiment" on the boy rather than permitting him to "die with dignity." Unless family members can articulate their fears and come to trust that the doctors and nurses will honestly tell them all relevant information, conflict is likely to arise. Consequently, fostering communication among all concerned parties — patient, family, nurses, other therapists, physicians and consultants — has been a primary goal and method of the subcommittee.

Being honest about the limitations of technology is essential. The subcommittee believes that the following philosophy should be conveyed to all patients and their families when someone is sick enough to enter intensive care.

First, if there is anything that can be done to restore the patient's health, it will be offered, and no technology will be omitted.

Second, all clinical judgments are fallible. There are multiple sources of expertise available to the primary doctor, yet out of all this expertise still comes a clinical judgment, the best one the doctor can make.

Third, we have nothing to hide from the patient. If opinions develop that the patient's condition is irreversible, i.e., that any treatment or technology available will not restore health, the patient and family should know this. Such an opinion includes the judgment that a particular treatment, because it cannot accomplish what the patient came to the hospital for, is unwarranted. This is even more true when the therapy itself carries a high morbidity or mortality. Should a patient with invasive bladder cancer, large doses of lower abdominal radiation and two fistulas be returned to surgery for the fourth time? With a patient severely burned over a sufficient portion of the body, it is possible to say with assurance that survival is unprecedented no matter what treatment is used. For the patient with bladder cancer no such formula exists. Nevertheless, the clinical judgment about the therapeutic values and limitations of further surgery is of critical importance to the average patient and family. The subcommittee believes that such judgments should be communicated to them. (Of course, the physician does not say to the patient, "We are not going to operate because you're not going to make it anyway," but something like, "We are not going to operate because it looks like the procedure seems more likely only to give you further problems with bleeding and fistulas than to improve the way things are now.")

Fourth, from the start patients and families should know that MGH has no interest in treating people with technology that won't make them feel better or in "experimenting" on them under the guise of treatment.

How do we operate? No one on the subcommittee works at it full time, so each consultation necessitates making cancellations in our schedules to attend to the emergency at hand. As soon as our help is solicited, five committee members are mobilized. (Our internist reviews medical patients, our surgeon surgical patients; occasionally both are called.) Since all cases are highly individual, I have selected several examples.

A sixty year old woman, the wife of a physician, was transferred from another hospital to our Respiratory Intensive Care Unit because of respiratory failure. An episode of low blood pressure had been followed by mild renal failure and circulatory failure in her feet, leaving them with incipient dry gangrene. Possibly having acquired Legionnaires' Disease, she was treated vigorously with mechanical ventilation and high dose end-expiratory pressure up to 25 cm. water. Both intravenous and intraarterial vasodilatory therapy were given in hopes of keeping to a minimum the damage to her feet. Her mental status was extremely difficult to judge because of the necessity of using paralyzing agents (e.g., pancuronium bromide) to facilitate her respiratory function.

Not only was her lung disease life threatening, but she also developed abdominal swelling diagnosed as a post-ischemic pancreatic phlegmon, and her liver function began to deteriorate. Her paroxysmal atrial tachycardia had been lifelong, although each time it erupted her blood pressure fell dangerously. After ten days' treatment with erythromycin she appeared no better. Sooner or later her gangrenous feet would have to be amputated.

This greatly distressed her husband who told the staff how his wife's sister, a diabetic, had undergone a bilateral amputation near the end of her life. His wife, he said, found her sister's experience so discouraging that she told him she would rather die than have an amputation — surely rather than have a bilateral amputation. She herself, during brief periods when she could communicate, did not appear to comprehend her surroundings or what was happening to her. Moreover, it was clear that her chances of dying from respiratory failure were substantial. The surgeon pointed out that waiting until gangrenous infection spread would force an even higher level of amputation.

Because of the dimensions of difficulty surrounding the decision, the primary physician consulted the subcommittee. Although every member reviewed the case, the primary physician's judgment about the reversibility of the respiratory disease remained suspended, depending on the clinical response of the patient to the ongoing therapy. Nevertheless it was opportune to have a meeting. The primary doctor, the surgical consultant, a member of the nursing staff, myself and the patient's husband met. (An invitation had been extended to the three adult children, but they did not appear for the meeting. No reason was given.) The primary doctor shared his concern about how seriously ill the patient was and her failing chances for recovery. If he were certain that she would not recover from her lung disease, then he favored omitting the amputation. If, however, there were some hope for her survival, then the amputation would have to be done fairly soon.

The husband was in full agreement with this reasoning: he wanted no amputation done if his wife were going to die anyway, but if she would actually pull through, then the lower the amputation the easier it would be for her to walk with prostheses. "I'll go by your judgment. If you think she's not going to make it, I'll trust you not to amputate; and if you think she can, then I'll go along with it." He asked if there were any way to tell for sure whether there was any chance of pulmonary recovery. The primary doctor said he planned on doing an open lung biopsy, which was known to be a relatively safe procedure in this setting. The justification would be that the extent of pulmonary fibrosis discovered might indicate almost certain failure to recover.

"In every case doctor, hospital staff, patient and family should struggle together to find the best solution."

With this in mind, the lung biopsy was performed. It revealed extensive fibrosis and collagenization of the lung parenchyma with cystic blebs. This was told to the patient's husband. To my surprise — and to the husband's, I thought — the primary doctor said he did not consider the biopsy picture bad enough to cancel the amputation. It was obvious to me that he agonized over this judgment. Yet, I asked myself, who was more qualified to say? He was doing research on relating lung biopsies to outcome. The patient's husband, too, simply said that he had to go along with the physician's judgment. The double amputation was scheduled for two days later. On the following day, rupture of pulmonary blebs created massive subcutaneous emphysema that further restricted her respiratory function. With this new event, her doctor became sufficiently convinced of the irreversibility of her disease that he cancelled the surgery. Her husband and family were notified of this turn for the worse and encouraged to be present or to pay her a final visit in accord with their wishes. She died quietly the following day.

The above scenario could have been different in many ways. The husband could have insisted that the doctor was overzealous for doing the biopsy and/or for going ahead with the amputation after the results were so ominous. But he had an excellent opportunity to question the doctor face to face and hear the reasons that made him decide as he did. He also had the satisfaction of making his own wishes clear and knowing that they were understood and respected. Our staff had the sense that the patient's children felt that their mother had been overtreated — making their absence at the conference all the more regrettable. In every case doctor, hospital staff, patient and family should struggle together to find the best solution.

When a doctor discusses treatments for a life threatening illness with a patient and his or her family, what is essential? Our committee believes that basically, these discussions always focus on a specific medical question, namely, the effect of a treatment on the illness. Treatments are justified because they benefit the patient. To a doctor this means that the treatment — at least partially — can restore health. The crux of the issue seems to be whether the treatment's ability to reverse the illness outweighs the pain and trauma it inflicts. In the case of the woman discussed above, whether to amputate was made secondary to the prognosis of her lung disease. If an engineer appeared on the scene with a new technological device that could reverse her lung disease, it would be welcomed by all. If someone appeared with an equally elaborate device, dramatically successful in treating other lung diseases but not hers, no one would permit its use in her case.

If a treatment does not have a beneficial effect on the disease, then some other reason has to justify its use. Some treatments, like narcotics for pain, while they have no effect on reversing an illness, are justified because of their ability to maintain comfort for the patient. A note left by the subcommittee, our standard practice, illustrates this point. A young man in his twenties survived multiple fractures and lacerated lungs sustained in an accident, only to succumb slowly to repeated infection. After consultation the note read: ". . . The impossibility of his sustaining further dialysis, the reappearance of relentless sepsis and possible DIC [diffuse intravascular coagulation] spell the end for hopes of reversibility of his illness at this point. The family (wife and mother) has been fully informed by Dr. ______. At this point it is clear that resuscitation is contraindicated and this has been communicated and is fully understood by his wife. All treatments on board are closely connected to his comfort, but his metabolic acidosis (last pH = 7.20) and decreasing pulmonary reserves indicate that his course toward death is beyond interruption. Escalation of pressors is not only not necessary at this point but, as it is clearly of no practical use in buying time, against the wishes of his wife as well. The staff has distinguished itself in making his family, especially his wife, an integral partner to treatment rationale, and at home in the ICU, as much as possible. The question has also been raised about lightening [her husband's] consciousness for the sake of further communication. She prefers, having had an excellent talk with him last night and finding him less responsive this a.m. (before medication), that he be kept sedated and comfortable. At this time his survival of the shift is questionable. Management of these difficulties continues to appear excellent and complete in all respects."

As indicated, we recommend — and are supported by the hospital in doing so — that all judgments and reasoning be made explicit in the chart by both primary physician and consultants. We firmly believe that a few of our patients, because they are irreversibly ill, need to be protected from well meant but misguided treatment efforts, and such protection is best given by explicit orders written in the chart. It is no disgrace to change either the opinion that the patient will not recover or the restrictions on treatment. Clinical judgments are based on how live patients do. They change and so does the physician in response to them. It is for this reason that our system relies on the primary doctor, does not make decisions by

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Dying.

When I look round
the I.C.U.
the old men, pipes and tubes
in every orifice,
I wonder that we're not gone daft.

No wonder PhD's
mole like, soft
write 600 pages, indices,
on how to die.

Does no one read of Charles'
unconscionable time a dying
or gentle Davy Hume
old songs, poems that knew
death is part of life?

We must struggle
against the dark goodnight
but there is a time to halt
and give gentle way,

A time not defined
by lawyer minds
but by good faith
and honest error.

So when I ebb
I hope for those of kindly bent,
friends love
and a little dignity.

— Hamish Gillies

"When our technologies are no longer appropriate, certain extreme measures are still indicated — exacting responsibility, extraordinary sensitivity, heroic compassion."

committee, and encourages continuous communication between staff, and patients and families. The chart should also include statements about individual family members, so that comprehensive care of the patient will include them. Such action alerts other staff members to what is happening to the family as well as to the patient.

I do not want to leave the reader with the impression that the work is over when the decision to maintain or limit life-supporting measures is reached. Once such a decision has been made, overall treatment must, if anything, be intensified, enabling the patient and family to meet death as peacefully and comfortably as possible. James Groves '72, while a resident here, once said to me that although modern critical care technology provides many miracles, it is an even greater miracle to have medical staff who are still willing, when ordinary technologies have failed to reverse an illness, to stand by the patient as life ends. The responsibility for making decisions to continue or omit treatment measures is awesome enough. Even when we decide that our advanced technologies are no longer appropriate, we can agree that certain extreme measures are still indicated — exacting responsibility, extraordinary sensitivity, heroic compassion.

Finally, a common objection to proceeding in the best interests of the patient is the fear of legal reprisals, like the murder charge lodged against Dr. Haemmerli — of which he was acquitted. In commenting on those physicians who rush to court in order to protect themselves in advance from the hazards of legal action, Justice Jacob Markowitz had this to say: "Men and women such as Semmelweis, Jenner, Curie, Sanger, Salk, Walter Reed, Lister, Pasteur and Wasserman would not be deterred by the mere fear of possible legal consequences of their acts. Many of them risked martyrdom to perpetuate the principles and ideals of the Hippocratic oath."[1] If the best interests of the patient were clear and the prognosis always evident, these decisions might be easy to make. The best any physician can do is, on the one hand, consult any and all experts who can advise about the illness and its treatment, and, on the other, convey to the patient and family the risks and benefits of embarking on possible treatment courses. As with any other treatment decision based on best available judgment, the profession must be willing to defend this in court.

Although our subcommittee's objective is not to protect the doctor from litigation, we believe such protection is best secured by efforts to provide optimal medical care. Our aim is to support the physician in determining what course of treatment serves the good of the individual patient and in discussing this openly with the patient and family.

References

1. Markowitz, J. Petition of Nemser, 51 Misc. 2d 616, 273 N.Y.S. 2d 624, Superior Court, 1966.

Letters

Treating Schwörbeldörfer

I enjoyed tremendously "A Legacy of 1848" in the July/August *Harvard Medical Alumni Bulletin.* I especially enjoyed Dr. Altschule's straight-faced discussion of Schwörbeldörfer's disease and agree that it is not only highly epidemic but also malignant. Perhaps he might consider adding one other feature of the disease and that is, if possible, it never must be treated by just one physician but, preferably, by a separate physician for each organ, none of whom knows what the other person is doing.

I was sad to hear of the death of Dr. Benjamin Alexander and thought Dr. Altschule's comments were again wonderfully appropriate. Incidentally, wasn't it Pangloss rather than Candide who thought that this world was the best of all possible worlds?

Yang Wang '52

Lieber Doktor Schörbeldörfer!

Danke so viel für your words uv Wahrheit, Witze, und Wisdom in das Bulletin. Wie always wusst' dat Sie would nicht pullen den Punches, but geben uns frische Insight in den Problematik der Praxis von Medicin.

Bitte, tellen Sie also ein Gruss an dat Mitglied von der Old School: Mark.

Hoch Achtung! svol
Ihre
Senft ('52)

Who was that man?

I am sorry that on page 10 of the July/August 1978 issue of the *Harvard Medical Alumni Bulletin* the alumnus speaking with President Quigley was not identified. He is Hall Seely '33, who came across the continent from Oregon for this reunion, a most welcome visitor. He is a very generous contributor to the Harvard Medical Alumni Fund. Certainly his identity should be acknowledged and therefore I am writing this letter to do so.

It might be of interest also that the group pictured on page 14 are all members of the forty-fifth reunion class of '33. The expression on the faces of these classmates is an indication of the pleasure which all of us had in that festive gathering.

Bradford Cannon '33

Self-study lessons

I should like to congratulate the Alumni Council, Dean Tosteson, and all those who participated in the "Institutional Self-Study of the Harvard Medical School," particularly those involved in the decision to publish it. While many of us may believe Harvard Medical School is somewhat unique, the dilemmas reflected in this report are not, and Dr. Culver's preface might be more appropriately titled, "Medical Schools, Study *and* Heal Thyself."

Entering medical students are superbly qualified and well-prepared to face the challenges provided by the ever-increasing body of knowledge. As the report suggests, there is an increasing competition among introductory courses and advanced basic science offerings, as well as an increasing emphasis on the social context in which knowledge is applied. One of the results of the latter is "an uneasiness about the attention given to soft disciplines — the social sciences and humanities."

Reading this report suggests that the time has come to recognize that there are two dimensions of learning, or two types of learning — cognitive or informational, and social. Of the twelve objectives for medical education listed in section one of the report, the first four might be considered to relate to the acquisition and application of knowledge. The last eight relate more to social learning, namely behavior related to the values reinforced in the learning environment, the presence of role models, and the like. Few of us believe that increasing the number of lectures by a factor of five or ten will accomplish the objectives of "working cooperatively with others . . . encouraging sensitivity . . ." While the social or "soft" objectives outnumber the others two to one, an analysis of the content of the ultimate reinforcements in medical education, such as comprehensive examinations and National Boards, reveals an extraordinary disparity between the volume of calls for concern with these factors, or the needs of certain segments of our population such as the aged, and the content of required examinations. (This is also true of specialty board examinations.)

Some of us would like to believe that students of the quality entering Harvard Medical School can learn almost anything, anywhere, and even in spite of the faculty. (The words of Walter Bradford Cannon still seem appropriate.) If this is true, then we, as the facilitators of medical education, need to be more concerned with engineering or creating learning environments that promote those values related to the achievement of "soft objectives." In such settings, the acquisition of knowledge related to the basic sciences and clinical problem solving can *also* occur, with equal or greater facility.

Perhaps this kind of educational engineering will not occur, and acute intellectual-informational-indigestion will develop into full-blown acid-stress disease requiring more radical treatment. If so, and it is necessary to limit the role of the physician to the application of the "hard sciences"* and relegate caring, or the application of the soft stuff, to others, then society as well as its social support system that includes medicine will be the loser.

Charles E. Lewis '53

* The rather pejorative classification of sciences into hard/soft does not reflect the basic intelligence of those involved. It is more indicative of the predictive power of relative scientific models (the r^2, that is), as well as the types of funding support that have been traditionally available to each.

I wish to commend the Harvard medical faculty and administration for their outstanding institutional self-study and to congratulate the *Alumni Bulletin* for its excellent publication of this work.

An institutional self-assessment is truly research in the classic sense with a "re-searching" of one's goals and objectives. It also provides an opportunity to examine all activities in order to more clearly identify problems and determine options for solutions. Too often in our busy lives we view this exercise as merely another task to be accomplished. It is done as quickly as possible when it should be utilized as an opportunity for a re-thinking and re-birth in the vitality and excitement of institutional life.

Harvard has again asserted its leadership in the medical education sphere with its own critical evaluation and I have urged our faculty to carefully review the summary publication in preparation for our own ten year self-study program.

Again, congratulations on a job exceptionally well done!

D. Kay Clawson '52
Dean, College of Medicine
University of Kentucky

I write to compliment [the editorial staff] for the excellent rendition of the Self-Study that appears in the May/June edition of the *Harvard Medical Alumni Bulletin*. I am particularly delighted with the [editor's] fine sonnet about our objectives. It is not only technically admirable, but also captures my sense of our spirit. I will be interested to see whether your challenge will reveal other poets in our midst.

Daniel C. Tosteson '48
Dean

Our contest is still open for alumni/ae interpretations of the "Objectives of HMS" in any literary form and style. (See pg. 20 of May/June.) The case of vintage sherry is starting to show its age. — Ed.

Watch your step

On page 42 of the May/June 1978 issue, I see the picture of one of the faculty descending marble steps, reading a copy of JAMA, and sliding his hand on the wooden handrail, and I presume this is in Building A!

I do not mean to be critical, since this may stress the pressures on faculty to keep current, or it could be that this is a faculty member who dislikes to be photographed. But I am dismayed that an undergraduate, as well as a graduate medical school, should portray such a dangerous, reckless, and thoughtless hazard, as is herein represented. Certainly OSHA, or countless safety engineers for large industrial concerns would reject as accident-prone an applicant they saw walking down marble steps, while concentrating his visual safeguards elsewhere and depending on a weak thumb to overcome the instantaneous and precipitate drag of 170 or more pounds. Polished and worn marble steps are harder than any members of the human anatomy, and it could be a painful method of suddenly losing the services of a faculty member.

We live in a very dangerous world, and it is none too soon to inculcate principles of safety in the students, who shortly will be responsible for the health and welfare of many others.

Charles J. McGee '37

Ether and HMS

In the May/June issue, Mr. Alan Burnham inquires about the discovery of ether. The brief reply omits many details of the connections of this discovery with Harvard Medical School. Although Davy, Faraday, and Priestley had speculated about possible applications of nitrous oxide and ether to painless surgery, and though students had used both in parties to stimulate excitement and exotic behavior, most medical historians credit the Georgian, Dr. Crawford Long, with the translation of these social experiences, often accompanied with seeming insensibility to pain, to the realm of minor surgery. He is credited with eight minor procedures under ether anesthesia before Morton's classical demonstration in 1846. Since he did not publish them until 1849, he receives no priority.

Dr. Horace Wells, a dentist in Hartford, Connecticut, began to use nitrous oxide in his practice around 1844. He was invited to give a demonstration at the Massachusetts General Hospital. The patient apparently lept up from the table when surgery was attempted, and the humble Dr. Wells never seriously pressed his claim.

Another dentist, trained in Baltimore, Dr. William G. Morton, was associated with Dr. Wells for some time and had occasion to observe the use of nitrous oxide. In 1844 he moved to Boston, enrolled at Harvard Medical School, and roomed with the family of Dr. Charles Jackson ('29), professor of chemistry at Harvard, who became his preceptor. Morton became deeply interested in the analgesic effects of ether. He tried it on himself, experimented on animals, extracted teeth painlessly under its influence, and persuaded Dr. John Collins Warren, professor of anatomy and surgery, to allow him to use it at the MGH. He did. Gilbert Abbott, a printer with a probable hemangioma of the jaw, was operated on on October 16, 1846.

Much of the credit of promoting and encouraging Morton's efforts belongs to Dr. Henry J. Bigelow ('41), then professor of surgery at HMS. He is given credit for the first announcement to the press and the publication of the first technical account of the event in the Boston Medical and Surgical Journal of November 18, 1846. (O tempora! O editorium mores!)

Morton became almost immediately embroiled in claims and counterclaims with Charles Jackson and others. He never graduated from HMS, "for economic reasons." Perhaps tuition even then was too high (seventy-five dollars per term) or perhaps giving anesthesia with his "Letheon" was too lucrative to allow him time to continue his medical studies. But the Congressional Record of 1864, in attempting to adjudicate rival claims to the discovery of ether, includes letters from 1854 signed by and addressed to "W. G. Morton, M.D." He is described as having received a medical degree from "Washington University in Maryland."